APPENDIX A

REFERENCES CITED

REFERENCES CITED

1. Hart, Earl W., 1994, Fault-Rupture Hazard Zones in California, Alquist Priolo, Special Studies Zones Act of 1972 California Division of Mines and Geology, Special Publication 42, revised 1994.

2. Jennings, Charles W., 197l, Fault Map of California with Locations of Volcanoes, Thermal Springs and Thermal Wells, revised.

3. Kennedy, M.P, 2000, "Geologic Maps of the Pala 7.5' Quadrangle San Diego County, California: A Digital Database," California Division of Mines and Geology, Las Angeles, California.

4. McCulloch, D.S., 1985, "Evaluating Tsunami Potential" *in* Ziony, J.I., ed., Evaluating Earthquake Hazards in the Los Angeles Region – An Earth-Science Perspective, U.S. Geological Survey Professional Paper 1360.

5. Western Soil and Foundation Engineering, Inc., 2005, "Geotechnical Investigation, Club Estates Subdivision, Pala Road, Pauma Valley, California", dated July 11, 2005 [consultant report].

APPENDIX B

FIELD EXPLORATION METHODS AND BORINGS LOGS

Soil Boring Methods

Relatively "Undisturbed" Soil Samples

Relatively "undisturbed" soil samples were collected using a modified California-drive sampler (2.4-inch inside diameter, 3-inch outside diameter) lined with sample rings. Drive sampling was conducted in general accordance with ASTM D-3550. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column "Blows/Foot" or "Blows/6 Inches." The soil was retained in brass rings (2.4 inches in diameter, 1.00 inch in height). The samples were retained and carefully sealed in waterproof plastic containers for shipment to the Construction Testing & Engineering ("CTE") geotechnical laboratory.

Disturbed Soil Sampling

Bulk soil samples were collected for laboratory analysis using two methods. Standard Penetration Tests (SPT) were performed according to ASTM D-1586 at selected depths in the borings using a standard (1.4-inches inside diameter, 2-inches outside diameter) split-barrel sampler. The steel sampler was driven into the bottom of the borehole with successive drops of a 140-pound weight falling 30-inches. Blow counts (N) required for sampler penetration are shown on the boring logs in the column "Blows/Foot" or "Blows/6 Inches." Samples collected in this manner were placed in sealed plastic bags. Bulk soil samples of the drill cuttings were also collected in large plastic bags. All disturbed soil samples were returned to the CTE geotechnical laboratory for analysis.

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS	SECONDARY DIVISIONS
COARSE GRAINED SOILS MORE THAN HALF OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	**GRAVELS** MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS < 5% FINES	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES LITTLE OR NO FINES
			GP	POORLY GRADED GRAVELS OR GRAVEL SAND MIXTURES, LITTLE OF NO FINES
		GRAVELS WITH FINES	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES
	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS < 5% FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES	SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES
FINE GRAINED SOILS MORE THAN HALF OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	**SILTS AND CLAYS** LIQUID LIMIT IS LESS THAN 50		ML	INORGANIC SILTS, VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, SLIGHTLY PLASTIC CLAYEY SILTS
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTS OR LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS LIQUID LIMIT IS GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTY CLAYS
HIGHLY ORGANIC SOILS			PT	PEAT AND OTHER HIGHLY ORGANIC SOILS

GRAIN SIZES

BOULDERS	COBBLES	GRAVEL		SAND			SILTS AND CLAYS
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" 4 10 40 200

CLEAR SQUARE SIEVE OPENING U.S. STANDARD SIEVE SIZE

ADDITIONAL TESTS

(OTHER THAN TEST PIT AND BORING LOG COLUMN HEADINGS)

MAX- Maximum Dry Density
GS- Grain Size Distribution
SE- Sand Equivalent
EI- Expansion Index
CHM- Sulfate and Chloride Content , pH, Resistivity
COR - Corrosivity
SD- Sample Disturbed

PM- Permeability
SG- Specific Gravity
HA- Hydrometer Analysis
AL- Atterberg Limits
RV- R-Value
CN- Consolidation
CP- Collapse Potential
HC- Hydrocollapse
REM- Remolded

PP- Pocket Penetrometer
WA- Wash Analysis
DS- Direct Shear
UC- Unconfined Compression
MD- Moisture/Density
M- Moisture
SC- Swell Compression
OI- Organic Impurities

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

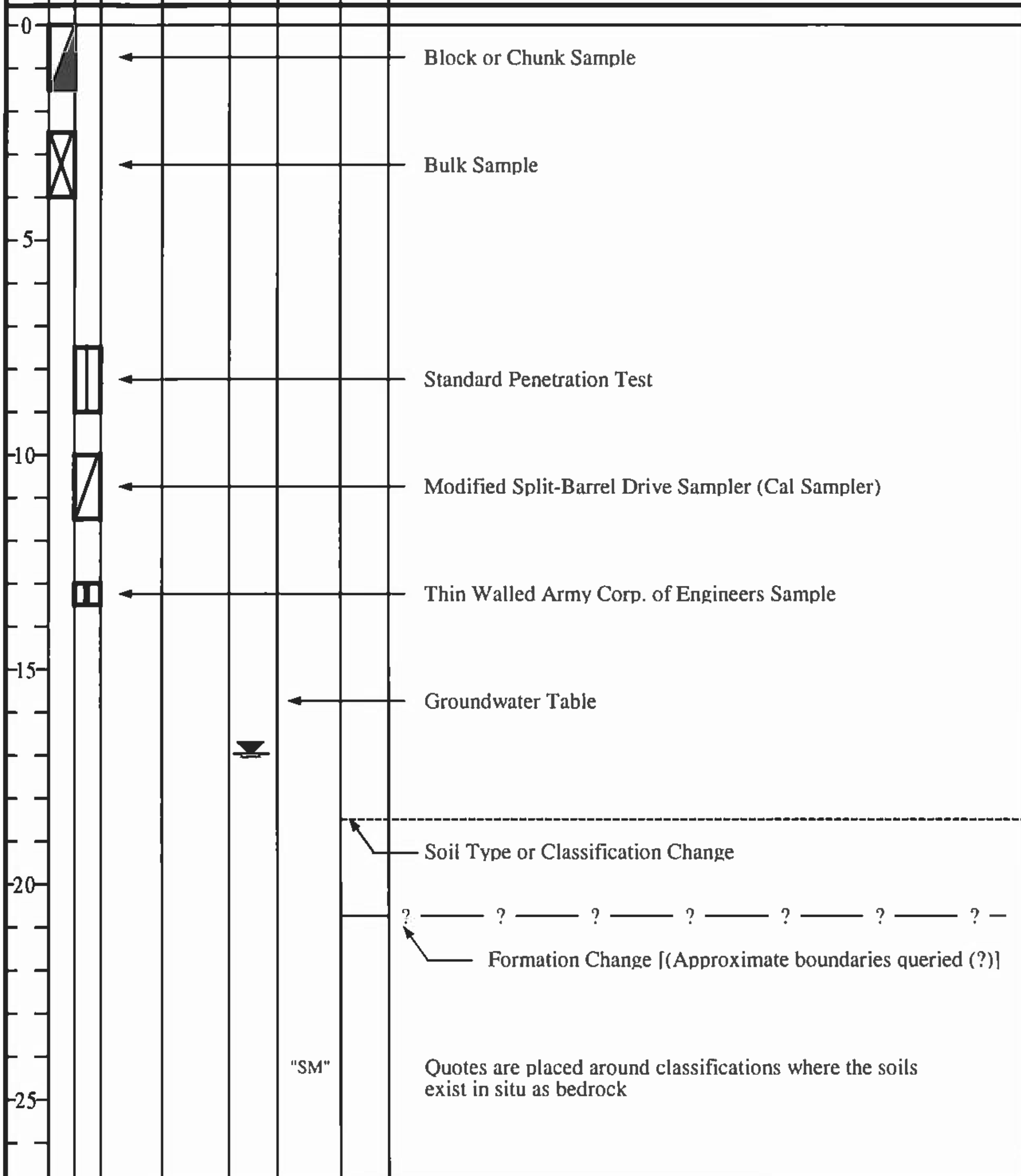
PROJECT:	DRILLER:	SHEET: of
CTE JOB NO:	DRILL METHOD:	DRILLING DATE:
LOGGED BY:	SAMPLE METHOD:	ELEVATION:

Depth (Feet) | Bulk Sample | Driven Type | Blows/Foot | Dry Density (pcf) | Moisture (%) | U.S.C.S. Symbol | Graphic Log

BORING LEGEND

DESCRIPTION

Laboratory Tests



0

Block or Chunk Sample

Bulk Sample

5

Standard Penetration Test

10

Modified Split-Barrel Drive Sampler (Cal Sampler)

Thin Walled Army Corp. of Engineers Sample

15

Groundwater Table

Soil Type or Classification Change

20

? —— ? —— ? —— ? —— ? —— ? —— ? —

Formation Change [(Approximate boundaries queried (?)]

"SM"

Quotes are placed around classifications where the soils exist in situ as bedrock

25

FIGURE: BL2

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	856

BORING: SB-1

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		ALLUVIUM (Qal): Loose, dry, brown silty fine grained SAND (SM).	
5			8 22 40	126.7	7.3			Dense, slightly moist, yellowish brown, silty fine grained SAND (SM), scattered gravel.	MD, CN
10			42 50					Very dense, slightly moist, yellowish brown, silty fine grained SAND (SM), scattered gravel.	
						GM		11'-12' Cobbles and gravel.	
15			12 28 32			SM		Very dense, slightly moist, brown, silty SAND (SM), fine grained with medium-coarse.	
						GM		17'-18' Cobbles and gravel.	
			50/4"			SM		Very dense, slightly moist, brown, silty SAND (SM), fine grained with medium-coarse.	
20								Total Depth 19.5' No Groundwater Hole Backfilled with Bentonite Chips	
25									

SB-1

Boring B-1

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	879

BORING: SB-2

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		ALLUVIUM (Qal): Loose, moist, dark gray brown, silty SAND (SM), fine to medium-grained.	
						GM		2'-4' Gravel and Cobbles.	
						SM		Very dense, slightly moist, gray brown, silty fine SAND (SM).	
5			28 50						WA CHEM
						CL		Hard, moist, reddish brown, sandy CLAY (CL).	
						SM		Medium dense, slightly moist, gray brown, silty fine SAND (SM).	
10			18 20 21	115.3	5.7				MD
15			18 30 32			SM		Very dense, slightly moist, yellowish brown, silty fine SAND (SM), with occasional gravel.	WA
			28 50			SM			WA
20								Total Depth 20' No Groundwater Hole Backfilled with Bentonite Chips	
25									

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760.746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	858

BORING: SB-3

Depth (Feet)	Sample: Bulk	Sample: Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		ALLUVIUM (Qal): Loose, moist, dark gray brown, silty SAND (SM), with scattered gravel and cobbles.	
	X								
3						GM		@ 3' Medium dense to dense, slightly moist, gray brown, silty GRAVEL (GM) with cobbles size clasts.	
6		X	20 50			SM		Very dense, slightly moist, gray brown, silty SAND (SM) with scattered gravel.	
10		X	12 18 32			GM		@ 10' Dense, slightly moist, gray brown, silty GRAVEL (GM) with cobble size clasts	GS
	X								
15			50/4"					No recovery.	
						SM		Very dense, slightly moist, gray brown, silty SAND (SM) with scattered gravel.	
			100/2"			GM		Very dense, slightly moist, gray brown, silty GRAVEL with cobble size clasts.	
19								Total Depth 19' No Groundwater Hole Backfilled with Bentonite Chips	
20									
25									

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	823

BORING: SB-4

Depth (Feet)	Bulk Sample	Driven Sample Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						SM		ALLUVIUM (Qal): Loose, dry, light gray brown, silty SAND (SM) with gravel.	
						GM		@ 3' Cobbles and boulders.	
5			10 15 30			SM		Dense, dry, light gray brown, silty fine SAND (SM), with occasional gravel and cobbles.	CN
10			50/6"	115.3	1.8	SP-SM		Dense, moist, olive brown, poorly graded SAND with silt and gravel (SP-SM) contains cobble sized clasts.	MD
15			18 50/4"					Becomes very dense.	GS
			50/4"						GS
20								Total Depth 19.5' No Groundwater Hole Backfilled with Bentonite Chips	
25									

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	819

BORING: SB-5

Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						GM		ALLUVIUM (Qal): Loose, dry, light gray brown, silty SAND (GM) with gravel and cobbles.	
								@ 3' Becomes medium dense.	
5									
						SM		@ 8' Dense slightly moist, gray brown, silty fine SAND (SM) with scattered gravel.	
10			12 18 32						
						CM		Dense, slightly moist, brown, silty fine GRAVEL (CM).	
15			42 50						
						SM		Very dense, moist, brown, silty fine SAND (SM).	
20			30 38 40						
								Total Depth 20.5' No Groundwater Hole Backfilled with Bentonite Chips	
25									

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746 4955

PROJECT:	CLUB ESTATES SUBDIVISION	DRILLER:	TEST AMERICA	SHEET:	1 of 1
CTE JOB NO:	10-7960G	DRILL METHOD:	8" HS AUGER	DRILLING DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLE METHOD:	CAL, SPT	ELEVATION:	800

BORING: SB-6

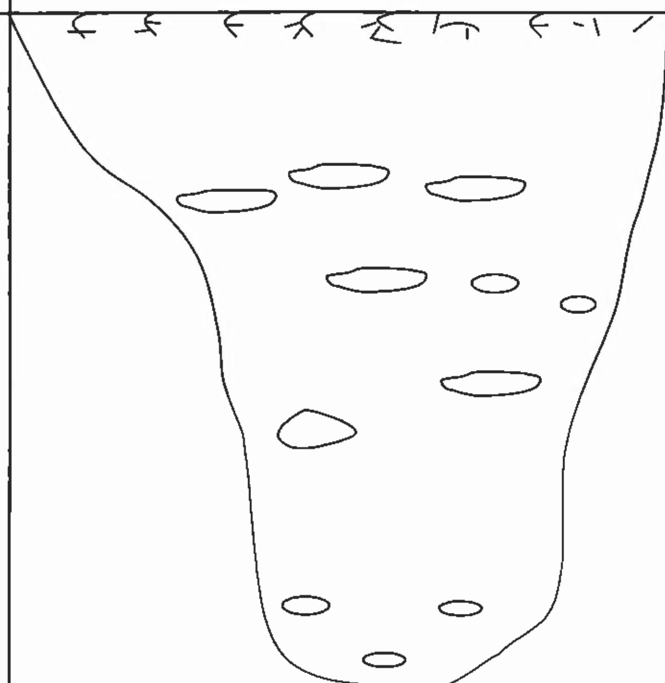
Depth (Feet)	Bulk Sample	Driven Type	Blows/Foot	Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	DESCRIPTION	Laboratory Tests
0						GM		<u>ALLUVIUM (Qal)</u>: Loose, dry, light gray brown, silty GRAVEL (GM) with cobbles.	
5			50/4"					@ 5' Dense.	
								Refusal at 10' on cobbles/boulders.	
10								Total Depth 10' No Groundwater Hole Backfilled with Bentonite Chips	
15									
20									
25									

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA [illegible]

PROJECT:	CLUB ESTATES SUBDIVISION	EXCAVATOR:	RANDALLS BACKHOE
CTE JOB NO:	10-7960G	EXCAVATION METHOD:	BACKHOE
LOGGED BY:	DK/DR	SAMPLING METHOD:	BULK, BAGGIE
EXCAVATION DATE:	9/27/2005	ELEVATION:	~822'

TEST PIT LOG: TP-1

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
				0			ALLUVIUM (Qal):	
					X		0-3': Loose, dry to moist, brown poorly graded SAND with silt and gravel (SP-SM) contains cobble sized clasts. Organics in upper foot.	RV, CHEM
		SP-SM						
		GC-GM					@ 3' Becomes medium dense and slightly moist, silty clayey GRAVEL (GC-GM) with weathered granitic cobbles to boulders (slightly to very weathered).	
				5				
				10	X			WA
				15				



Total Depth 13'
No Groundwater
Backfilled with Spoils

FIGURE: TP-1

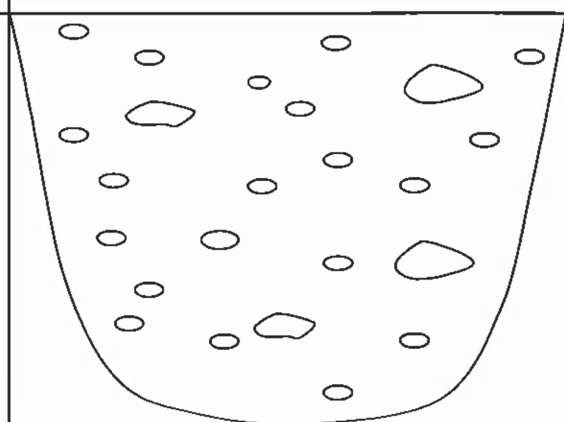
CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	EXCAVATOR:	RANDALLS BACKHOE		
CTE JOB NO:	10-7960G	EXCAVATION METHOD:	BACKHOE	EXCAVATION DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLING METHOD:	BULK, BAGGIE	ELEVATION:	~808'

TEST PIT LOG: TP-2

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
		SP-SM		0	X		0-8' ALLUVIUM (Qal): Loose, dry, gray brown, fine to coarse poorly graded SAND with silt and gravel and cobbles. Trace boulders sloughing and caving of sidewalls, unstable.	MAX
				5				
				10				
				15				



Total Depth 8'
No Groundwater
Backfilled with Spoils

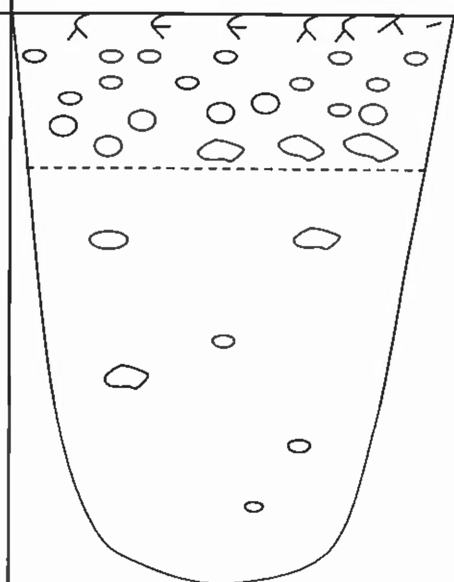
FIGURE: TP-2

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760.746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	EXCAVATOR:	RANDALLS BACKHOE		
CTE JOB NO:	10-7960G	EXCAVATION METHOD:	BACKHOE	EXCAVATION DATE:	9/27/2005
LOGGED BY:	DK/DR	SAMPLING METHOD:	BULK, BAGGIE	ELEVATION:	~809'

TEST PIT LOG: TP-3

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
		SM		0			0-11' ALLUVIUM (Qal): Loose, dry, brown fine silty SAND with gravels to boulders in upper 3 feet.	
		SM		5			@ 2' Becomes slightly moist, caving and sloughing of trench walls.	
				10				
				15				



Total Depth 11'
No Groundwater
Hole Backfilled with Spoils

FIGURE: TP-3

CONSTRUCTION TESTING & ENGINEERING, INC.

GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	EXCAVATOR:	RANDALLS BACKHOE
CTE JOB NO:	10-7960G	EXCAVATION METHOD:	BACKHOE
LOGGED BY:	DK/DR	SAMPLING METHOD:	BULK, BAGGIE

EXCAVATION DATE: 9/27/2005
ELEVATION: ~833'

TEST PIT LOG: TP-4

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
				0			0-2' ALLUVIUM (Qal): Loose to medium dense, dry to slighlty moist, silty fine SAND with gravels, cobbles and boulders, organics in upper foot.	
							@ 2' Becomes more loose, slightly moist.	
		SM		5	X			WA
					X		@ 8' Becomes medium dense to dense.	MAX
				10			Total Depth 10' No Groundwater Backfilled with Spoils	
				15				

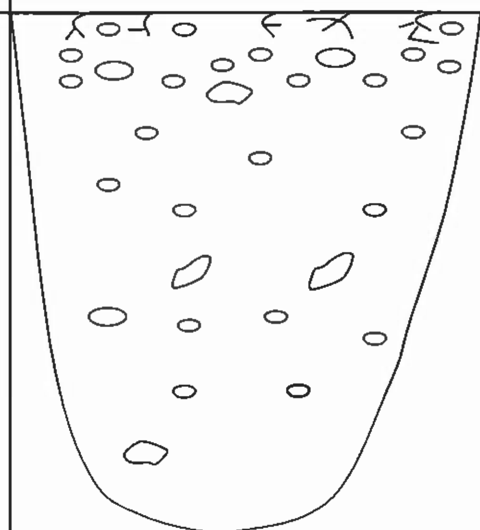


FIGURE: TP-4

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD SUITE 115 | ESCONDIDO, CA 92026 | 760.746.4955

PROJECT:	CLUB ESTATES SUBDIVISION	EXCAVATOR:	RANDALLS BACKHOE
CTE JOB NO:	10-7960G	EXCAVATION METHOD:	BACKHOE
LOGGED BY:	DK/DR	SAMPLING METHOD:	BULK, BAGGIE
EXCAVATION DATE:	9/27/2005	ELEVATION:	~846'

TEST PIT LOG: TP-5

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Type: Bulk	Sample Type: Driven	DESCRIPTION	Laboratory Tests
				0			0-9.5' ALLUVIUM (Qal): Loose to medium dense, dry, silty SAND with gravel and cobbles, trace boulders.	
		SW-SM					@ 3' Slightly moist.	
				5			Harder digging due to cobble and boulders.	
				10			Total Depth 9.5' No Groundwater Hole Backfilled with Spoils	
				15				

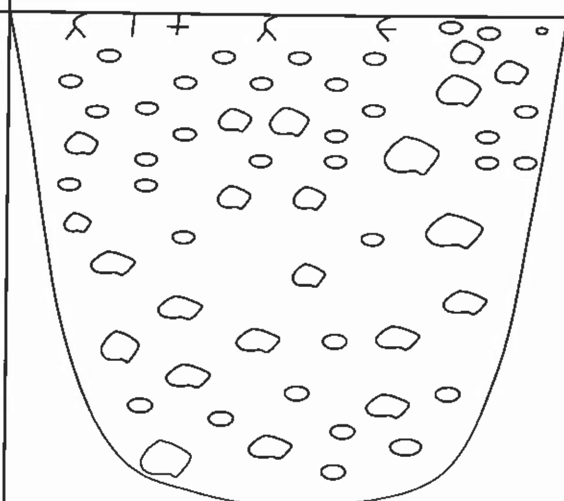


FIGURE: TP-5

CONSTRUCTION TESTING & ENGINEERING, INC.
GEOTECHNICAL | CONSTRUCTION ENGINEERING TESTING AND INSPECTION
1441 MONTIEL ROAD, SUITE 115 | ESCONDIDO, CA 92026 | 760 746.4955

PROJECT: CLUB ESTATES SUBDIVISION	EXCAVATOR: RANDALLS BACKHOE		
CTE JOB NO: 10-7960G	EXCAVATION METHOD: BACKHOE	EXCAVATION DATE: 9/27/2005	
LOGGED BY: DK/DR	SAMPLING METHOD: BULK, BAGGIE	ELEVATION: ~822'	

TEST PIT LOG: TP-6

Dry Density (pcf)	Moisture (%)	U.S.C.S. Symbol	Graphic Log	Depth (Feet)	Sample Bulk	Sample Type Driven	DESCRIPTION	Laboratory Tests
				0			0-10' ALLUVIUM (Qal): Loose, dry, silty SAND with boulders and cobbles, sloughing of the trench wall.	
		SM					@ 3' Slightly moist.	
				5			@ 7' Less cobbles and boulders.	
				10			Soft digging at 10'.	
							Total Depth 10' No Groundwater Backfilled with Spoils	
				15				

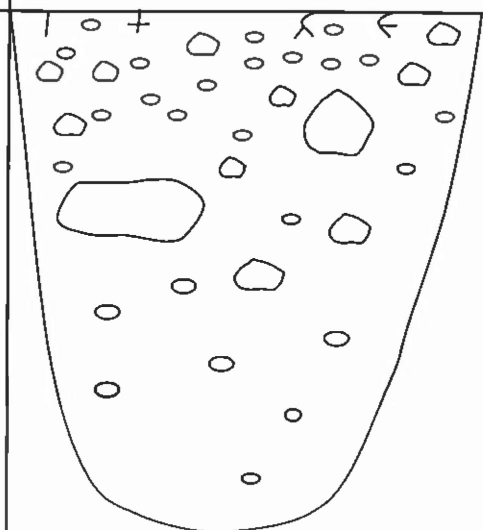


FIGURE: TP-6

APPENDIX C

LABORATORY METHODS AND RESULTS

APPENDIX C
LABORATORY METHODS AND RESULTS

Laboratory tests were performed on representative soil samples to detect their relative engineering properties. Tests were performed following test methods of the American Society for Testing Materials or other accepted standards. The following presents a brief description of the various test methods used. Laboratory results are presented in the following section of this Appendix.

Classification
Soils were classified visually according to the Unified Soil Classification System. Visual classifications were supplemented by laboratory testing of selected samples according to ASTM D2487.

Particle-Size Analysis
Particle-size analyses were performed on selected representative samples according to ASTM D422.

In-Place Moisture and Density
To determine the moisture and density of in-place site soils, a representative sample was tested for the moisture and density at time of sampling.

Consolidation
To assess their compressibility and volume change behavior when loaded and wetted, relatively undisturbed samples of representative samples from the investigation were subject to consolidation tests (ASTM D2435).

Resistance "R"-Value
The resistance "R"-value was determined by the California Materials Method No. 301 for representative subbase soils. Samples were prepared and exudation pressure and "R"-value determined. The graphically determined "R"- value at exudation pressure of 300 psi is the value used for pavement section calculation.

Chemical Analysis
Soil materials were collected with sterile sampling equipment and tested for Sulfate and Chloride content, pH, Corrosivity, and Resistivity.

Modified Proctor
To determine the maximum dry density and optimum moisture content, a soil sample was tested in accordance with ASTMD-1557.

200 WASH ANALYSIS

LOCATION	DEPTH (feet)	PERCENT PASSING #200 SIEVE	CLASSIFICATION
SB-2	5	12.4	SW-SM
SB-2	15	19.1	SM
SB-2	19	15.9	SM
TP-1	10.5		
TP-4	5		

IN-PLACE MOISTURE AND DENSITY

LOCATION	DEPTH (feet)	% MOISTURE	DRY DENSITY
SB-1	5	7.3	126.7
SB-2	10	1.8	115.3
SB-4	10	5.7	115.3

RESISTANCE "R"-VALUE

CALTEST 301

LOCATION	DEPTH (feet)	R-VALUE
TP-1	1	66

SULFATE

LOCATION	DEPTH (feet)	RESULTS ppm
SB-2	5	66
TP-1	1	46

CHLORIDE

LOCATION	DEPTH (feet)	RESULTS ppm
SB-2	5	31
TP-1	1	21

CONDUCTIVITY

CALIFORNIA TEST 424

LOCATION	DEPTH (feet)	RESULTS uS/cm
SB-2	5	69
TP-1	1	60.7

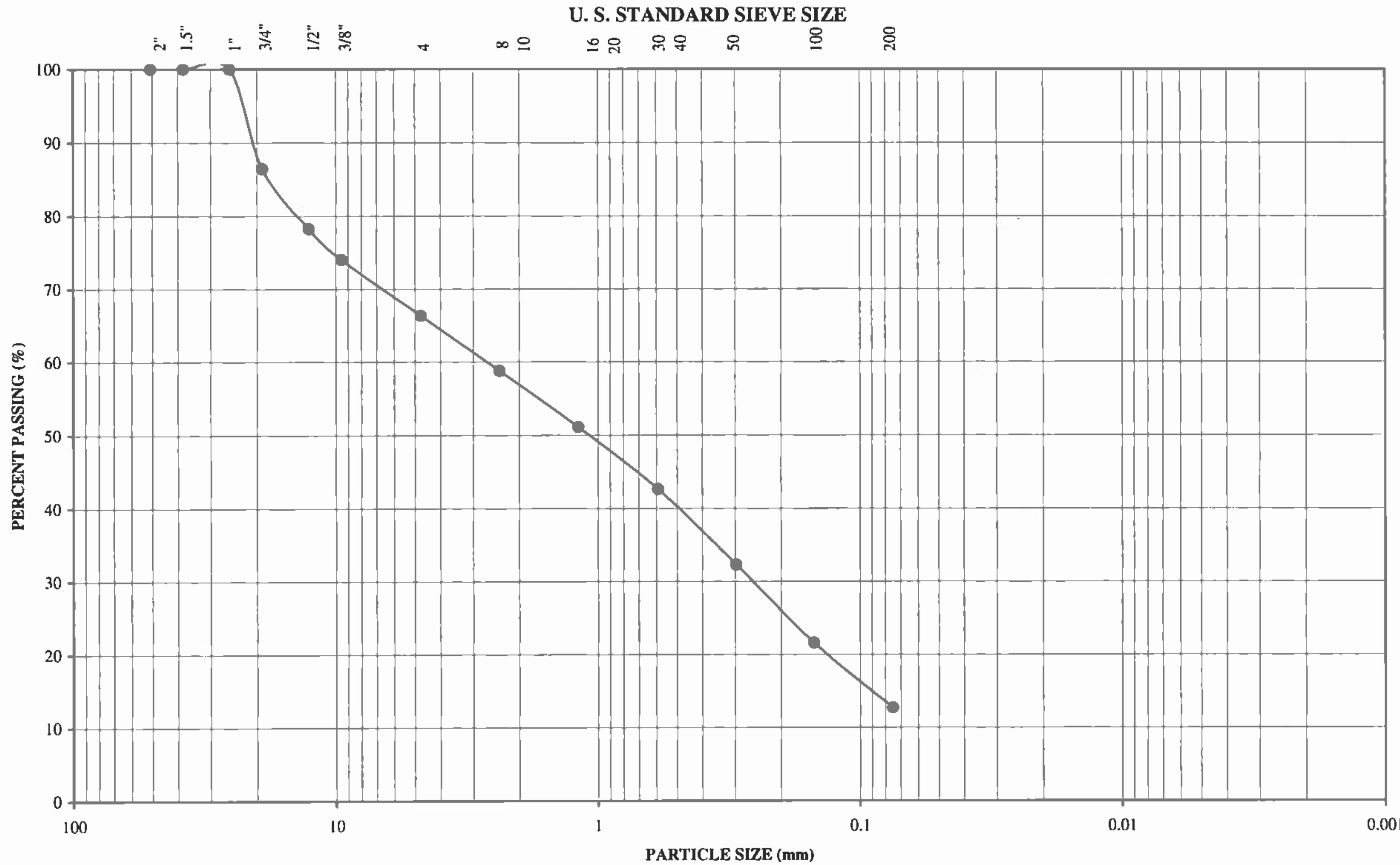
RESISTIVITY

CALIFORNIA TEST 424

LOCATION	DEPTH (feet)	RESULTS ohms/cm
B-4	0-5	12000
B-4	10-13	13700

MAXIMUM DENSITY
(MODIFIED PROCTOR)

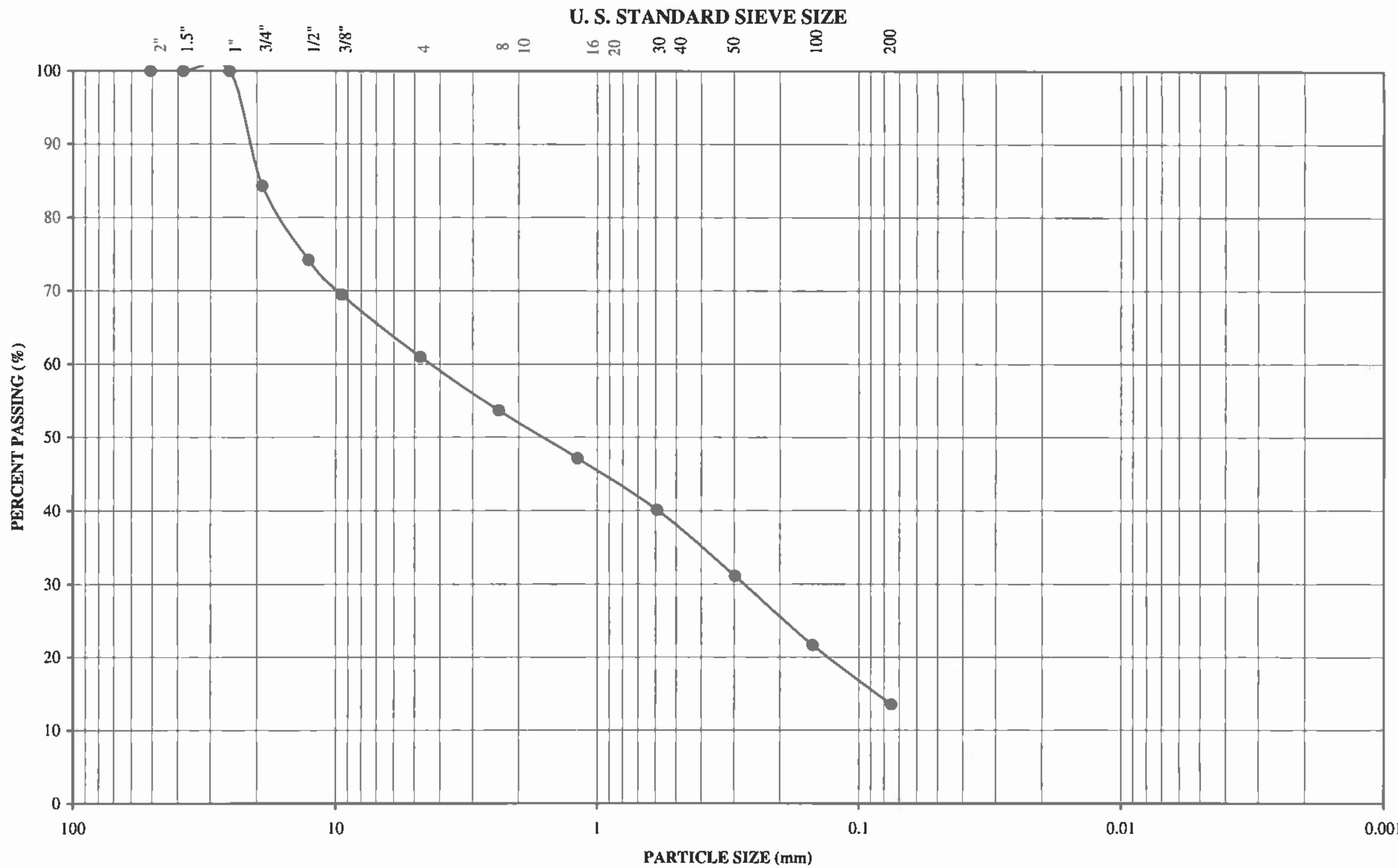
LOCATION	DEPTH (feet)	OPTIMUM MOISTURE (%)	DRY DENSITY (pcf)
TP-2	1-2	8.0	130.5
TP-4	9	8.0	138.5



PARTICLE SIZE ANALYSIS

CONSTRUCTION TESTING & ENGINEERING, INC.

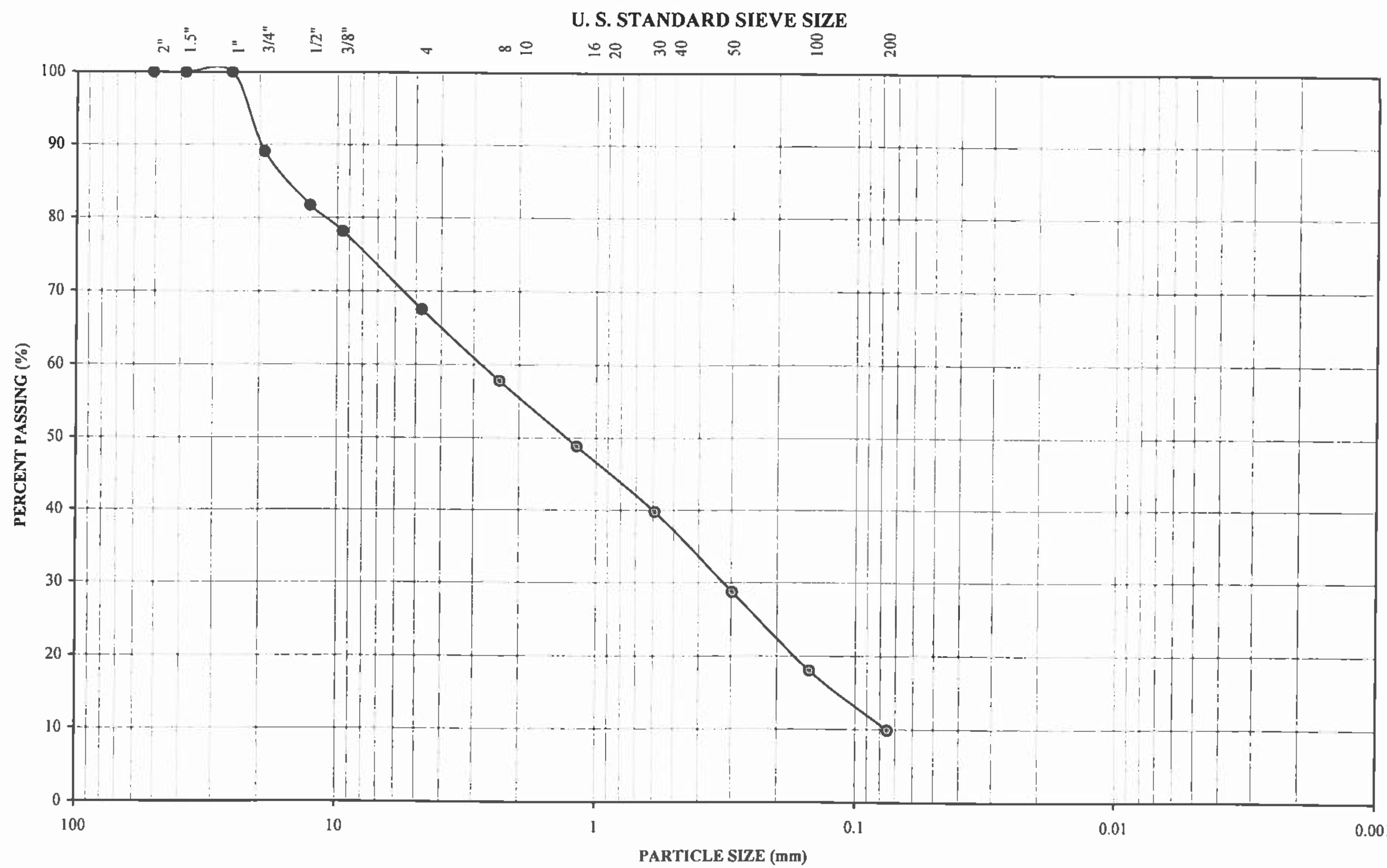
Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
SB-3	10	●	-	-	SM
CTE JOB NUMBER:		10-7960G		FIGURE:	C-3



PARTICLE SIZE ANALYSIS

CONSTRUCTION TESTING & ENGINEERING, INC.

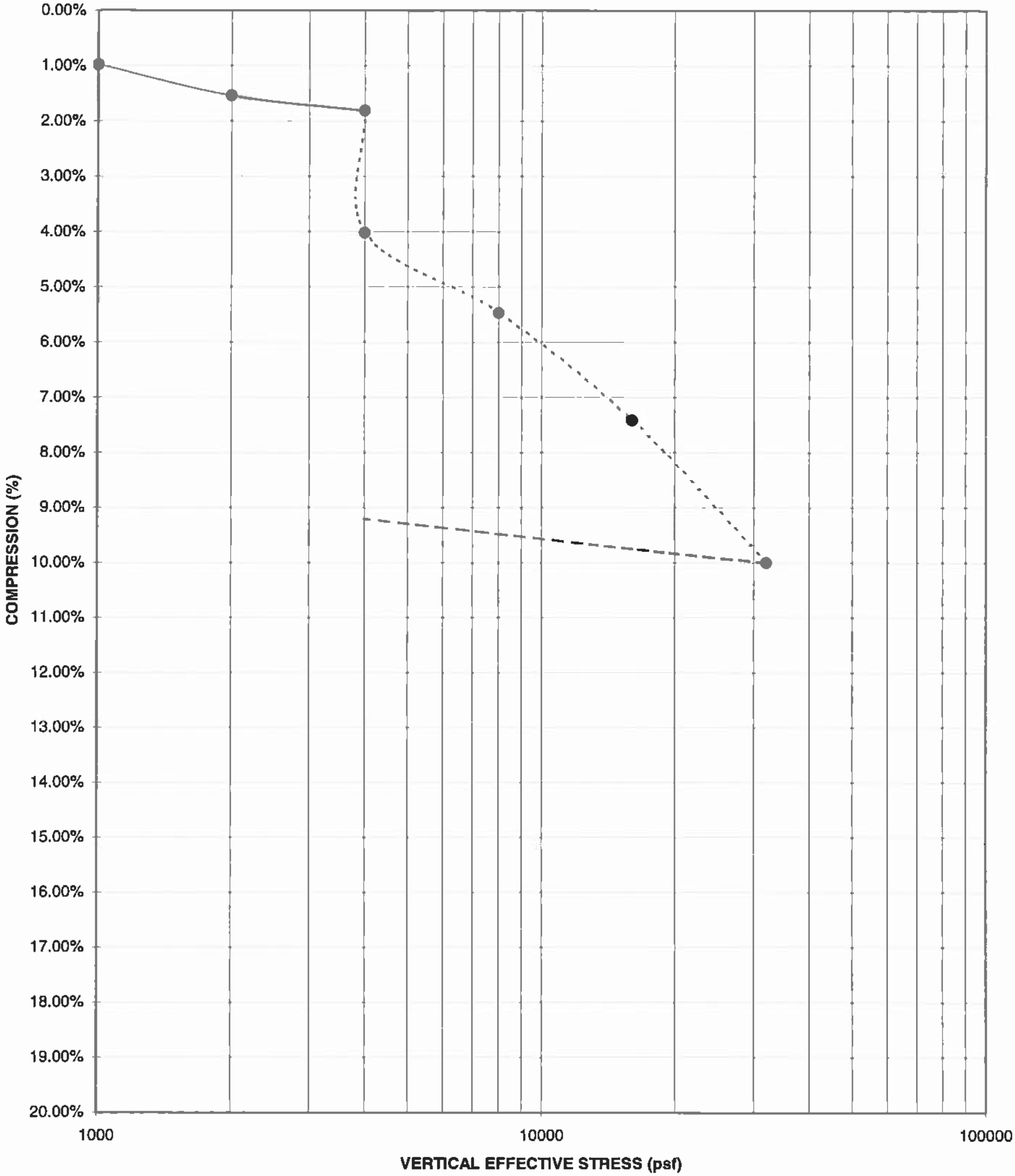
Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
SB-4	15	●	-	-	SM
CTE JOB NUMBER:		10-7960G		FIGURE:	C-4



PARTICLE SIZE ANALYSIS

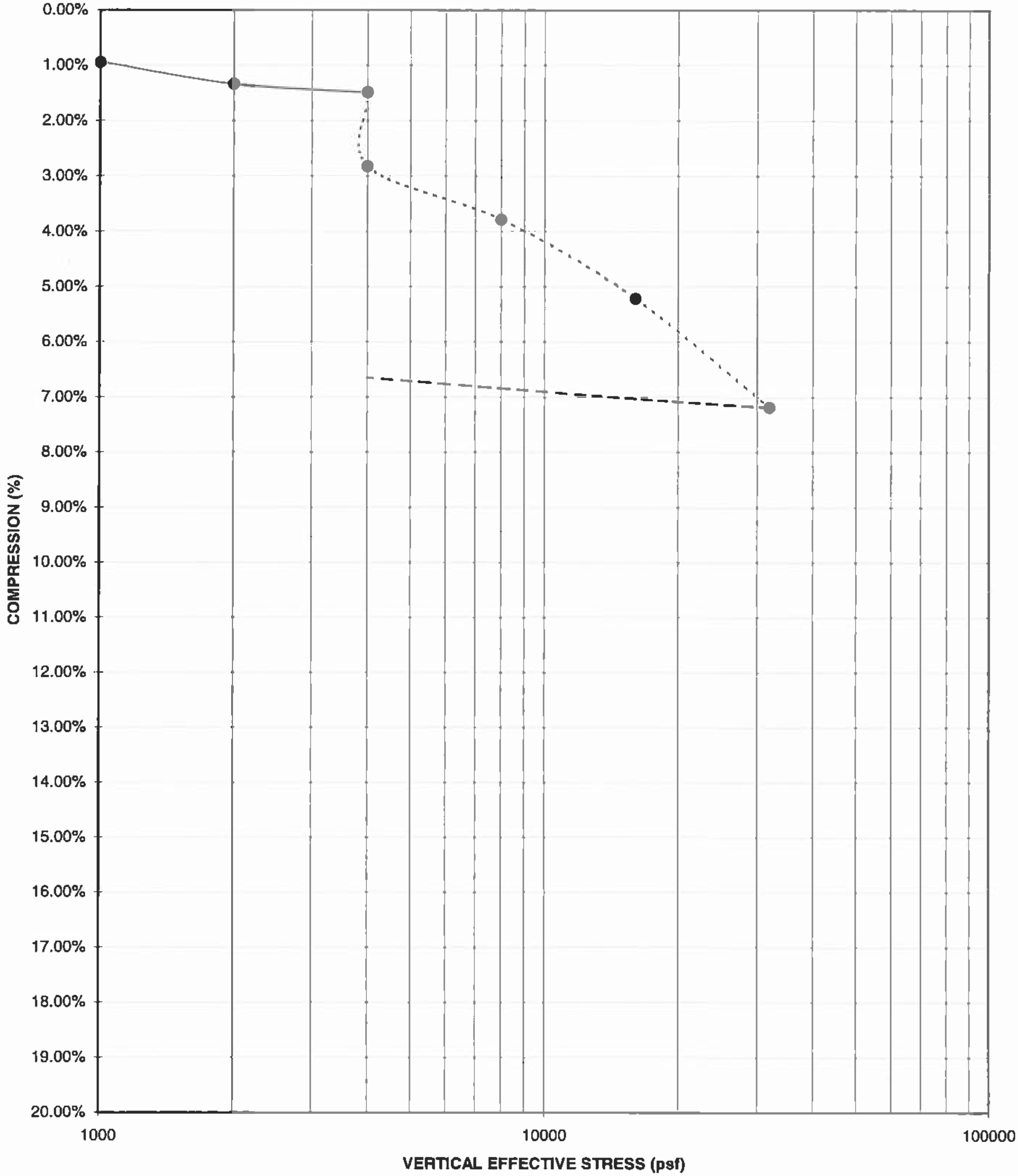
CONSTRUCTION TESTING & ENGINEERING, INC.

Sample Designation	Sample Depth (feet)	Symbol	Liquid Limit (%)	Plasticity Index	Classification
SB-4	19	●	-	-	SP-SM
CTE JOB NUMBER:	10-7960G		FIGURE:	C-5	



SWELL/COMPRESSION TEST			
Sample Designation	Depth (ft)	Symbol	Legend
SB-1	5'	●	——— FIELD MOISTURE -------- SAMPLE SATURATED – – – – REBOUND

Initial Moisture (%):	7.3	Initial Dry Density (pcf)	126.7	CTE JOB NO: 10-7960G
Final Moisture (%):	12.3	Final Dry Denstiy (pcf)	121.1	FIGURE NO: C-6



SWELL/COMPRESSION TEST			
Sample Designation	Depth (ft)	Symbol	Legend
SB-4	10'	●	——— FIELD MOISTURE - - - - - - SAMPLE SATURATED — — — REBOUND

Initial Moisture (%):	1.8	Initial Dry Density (pcf)	115.3	CTE JOB NO: 10-7960G
Final Moisture (%):	18.5	Final Dry Denstiy (pcf)	99.1	FIGURE NO: C-7

APPENDIX D

STANDARD SPECIFICATIONS FOR GRADING

Section 1 - General

The guidelines contained herein and the standard details attached hereto represent Construction Testing & Engineering's standard recommendations for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications. Recommendations contained in the body of the previously presented soils report shall supersede the recommendations and or requirements as specified herein. The project geotechnical consultant shall interpret disputes arising out of interpretation of the recommendations contained in the soils report or specifications contained herein.

Section 2 - Responsibilities of Project Personnel

The geotechnical consultant should provide observation and testing services sufficient to assure that geotechnical construction is performed in general conformance with project specifications and standard grading practices. The geotechnical consultant should report any deviations to the client or his authorized representative.

The Client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the geotechnical consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services. During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project.

The Contractor should be responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including, but not limited to, earth work in accordance with the project plans, specifications and controlling agency requirements.

Section 3 - Preconstruction Meeting

A preconstruction site meeting shall be arranged by the owner and/or client and shall include the grading contractor, the design engineer, the geotechnical consultant, owner's representative and representatives of the appropriate governing authorities.

Section 4 - Site Preparation

The client or contractor should obtain the required approvals from the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, root of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.

Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and other man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or rerouting pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the geotechnical consultant at the time of demolition.

Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the contractor from damage or injury.

Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the geotechnical consultant.

Section 5 - Site Protection

Protection of the site during the period of grading should be the responsibility of the contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the geotechnical consultant, the client and the regulating agencies.

Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas cannot be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.

Rain related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions as determined by the geotechnical consultant. Soil adversely affected should be classified as unsuitable materials and should be subject to overexcavation and replacement with compacted fill or other remedial grading as recommended by the geotechnical consultant.

The contractor should be responsible for the stability of all temporary excavations. Recommendations by the geotechnical consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and, therefore, should not be considered to preclude the responsibilities of the contractor. Recommendations by the geotechnical consultant should not be considered to preclude requirements that are more restrictive by the regulating agencies. The contractor should provide during periods of extensive rainfall plastic sheeting to prevent unprotected slopes from becoming saturated and unstable.

When deemed appropriate by the geotechnical consultant or governing agencies the contractor shall install checkdams, desilting basins, sand bags or other drainage control measures.

In relatively level areas and/or slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1.0 foot; they should be overexcavated and replaced as compacted fill in accordance with the applicable specifications. Where affected materials exist to depths of 1.0 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. If field conditions dictate, the geotechnical consultant may recommend other slope repair procedures.

Section 6 - Excavations

6.1 Unsuitable Materials

Materials that are unsuitable should be excavated under observation and recommendations of the geotechnical consultant. Unsuitable materials include, but may not be limited to, dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft bedrock and nonengineered or otherwise deleterious fill materials.

Material identified by the geotechnical consultant as unsatisfactory due to its moisture conditions should be overexcavated; moisture conditioned as needed, to a uniform at or above optimum moisture condition before placement as compacted fill.

If during the course of grading adverse geotechnical conditions are exposed which were not anticipated in the preliminary soil report as determined by the geotechnical consultant additional exploration, analysis, and treatment of these problems may be recommended.

6.2 Cut Slopes

Unless otherwise recommended by the geotechnical consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal: vertical).

The geotechnical consultant should observe cut slope excavation and if these excavations expose loose cohesionless, significantly fractured or otherwise unsuitable material, the materials should be overexcavated and replaced with a compacted stabilization fill. If encountered specific cross section details should be obtained from the Geotechnical Consultant.

When extensive cut slopes are excavated or these cut slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top of the slope.

6.3 Pad Areas

All lot pad areas, including side yard terrace containing both cut and fill materials, transitions, located less than 3 feet deep should be overexcavated to a depth of 3 feet and replaced with a uniform compacted fill blanket of 3 feet. Actual depth of overexcavation may vary and should be delineated by the geotechnical consultant during grading.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm drainage swale and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slopes of 2 percent or greater is recommended.

Section 7 - Compacted Fill

All fill materials should have fill quality, placement, conditioning and compaction as specified below or as approved by the geotechnical consultant.

7.1 Fill Material Quality

Excavated on-site or import materials which are acceptable to the geotechnical consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement. All import materials anticipated for use on-site should be sampled tested and approved prior to and placement is in conformance with the requirements outlined.

Rocks 12 inches in maximum and smaller may be utilized within compacted fill provided sufficient fill material is placed and thoroughly compacted over and around all rock to effectively fill rock voids. The amount of rock should not exceed 40 percent by dry weight passing the 3/4-inch sieve. The geotechnical consultant may vary those requirements as field conditions dictate.

Where rocks greater than 12 inches but less than four feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with attached Plates and described below. Rocks greater than four feet should be broken down or disposed off-site.

7.2 Placement of Fill

Prior to placement of fill material, the geotechnical consultant should inspect the area to receive fill. After inspection and approval, the exposed ground surface should be scarified to a depth of 6 to 8 inches. The scarified material should be conditioned (i.e. moisture added or air dried by continued discing) to achieve a moisture content at or slightly above optimum moisture conditions and compacted to a minimum of 90 percent of the maximum density or as otherwise recommended in the soils report or by appropriate government agencies.

Compacted fill should then be placed in thin horizontal lifts not exceeding eight inches in loose thickness prior to compaction. Each lift should be moisture conditioned as needed, thoroughly blended to achieve a consistent moisture content at or slightly above optimum and thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials and weather conditions.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal: vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least six-foot wide benches and a minimum of four feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area after keying and benching until the geotechnical consultant has reviewed the area. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface or previously compacted fill should be processed by scarification, moisture conditioning as needed to at or slightly above optimum moisture content, thoroughly blended and recompacted to a minimum of 90 percent of laboratory maximum dry density. Where unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be over-excavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

Rocks 12 inch in maximum dimension and smaller may be utilized in the compacted fill provided the fill is placed and thoroughly compacted over and around all rock. No oversize material should be used within 3 feet of finished pad grade and within 1 foot of other compacted fill areas. Rocks 12 inches up to four feet maximum dimension should be placed below the upper 5 feet of any fill and should not be closer than 11 feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures or deep utilities are proposed. Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so those successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the geotechnical consultant at the time of placement.

The contractor should assist the geotechnical consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill. The contractor should provide this work at no additional cost to the owner or contractor's client.

Fill should be tested by the geotechnical consultant for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Test D 1556-82, D 2922-81. Tests should be conducted at a minimum of 2 vertical feet or 1,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the geotechnical consultant.

7.3 Fill Slopes

Unless otherwise recommended by the geotechnical consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal: vertical).

Except as specifically recommended in these grading guidelines compacted fill slopes should be over-built and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the geotechnical consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

At the discretion of the geotechnical consultant, slope face compaction may be attempted by conventional construction procedures including backrolling. The procedure must create a firmly compacted material throughout the entire depth of the slope face to the surface of the previously compacted firm fill intercore.

During grading operations, care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately established desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding four feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly dozer trackrolled.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished using a berm and pad gradient of at least 2 percent.

Section 8 - Trench Backfill

Utility and/or other excavation of trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 90 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to one foot wide and two feet deep may be backfilled with sand and consolidated by jetting, flooding or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of backfill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the contractor may elect the utilization of light weight mechanical compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review of the geotechnical consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the geotechnical consultant. Clean granular backfill and/or bedding are not recommended in slope areas.

Section 9 - Drainage

Where deemed appropriate by the geotechnical consultant, canyon subdrain systems should be installed in accordance.

Typical subdrains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications of the accompanying attached plates.

Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, and concrete swales) as shown in the attached plates.

For drainage in extensively landscaped areas near structures, (i.e., within four feet) a minimum of 5 percent gradient away from the structure should be maintained. Pad drainage of at least 2 percent should be maintained over the remainder of the site.

Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns could be detrimental to slope stability and foundation performance.

Section 10 - Slope Maintenance

10.1 - Landscape Plants

To enhance surficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the southern California area and plants relative to native plants are generally desirable. Plants native to other semi-arid and arid areas may also be appropriate. A Landscape Architect should be the best party to consult regarding actual types of plants and planting configuration.

10.2 - Irrigation

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.

Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.

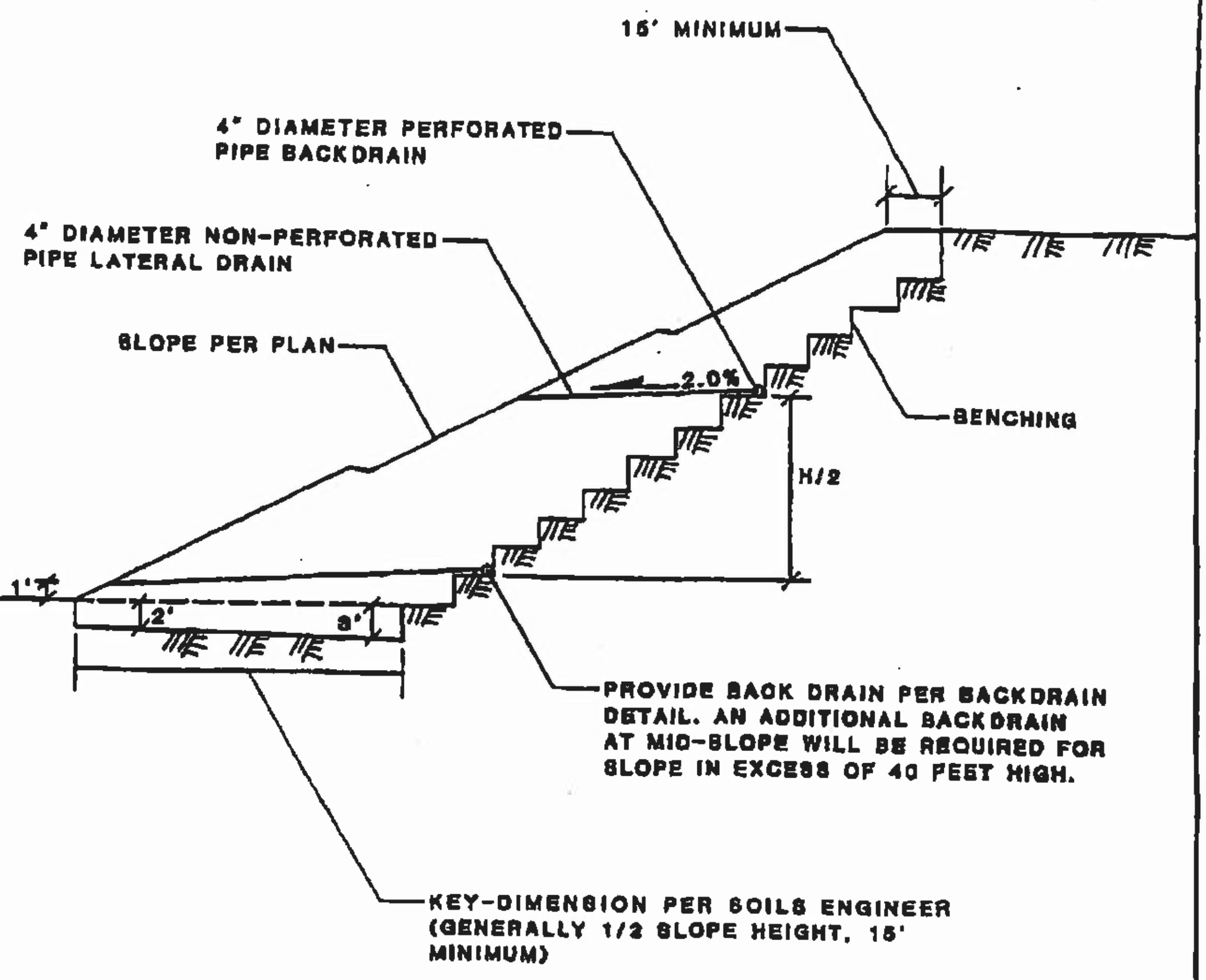
10.3 - Repair

As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period prior to landscape planting.

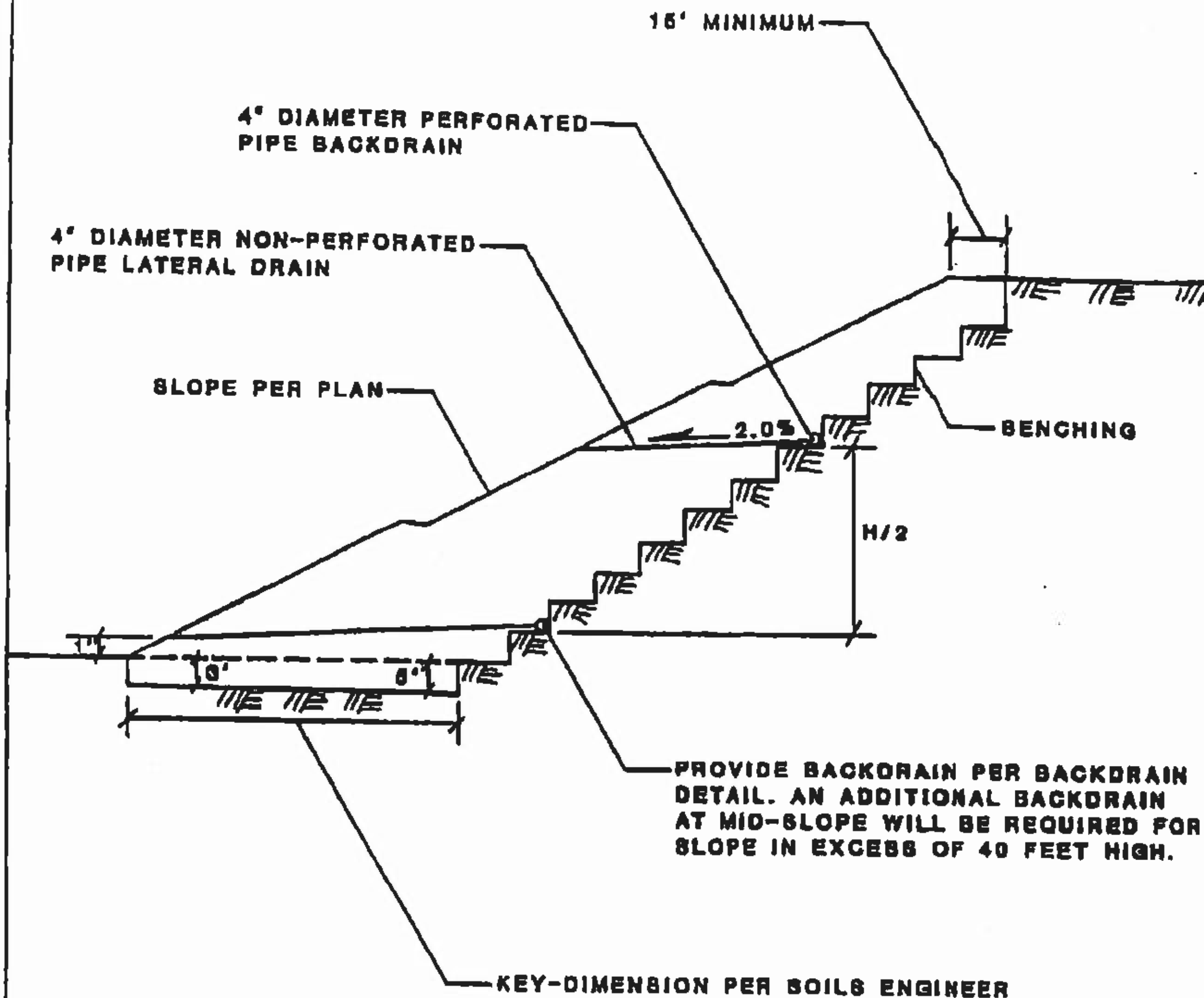
If slope failures occur, the geotechnical consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

If slope failures occur as a result of exposure to period of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

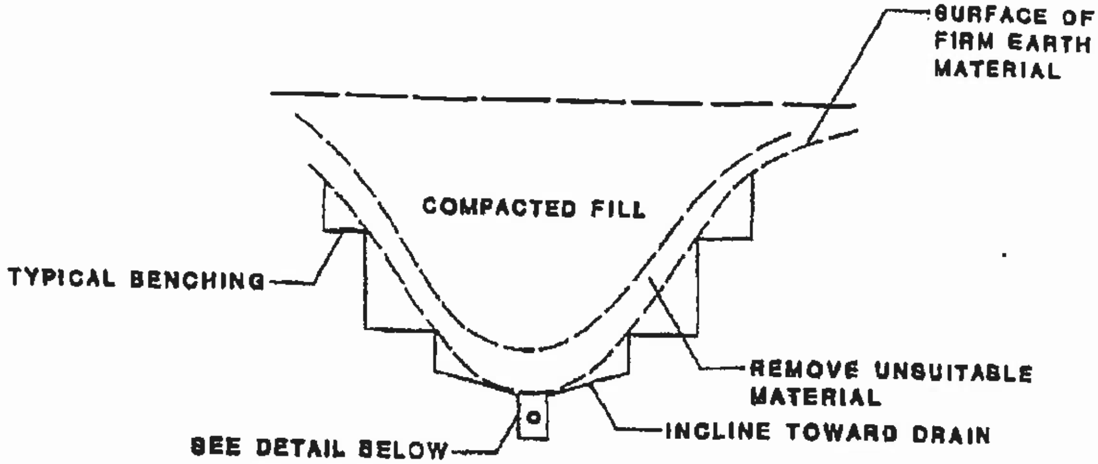
In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer one foot to three feet of a slope face).



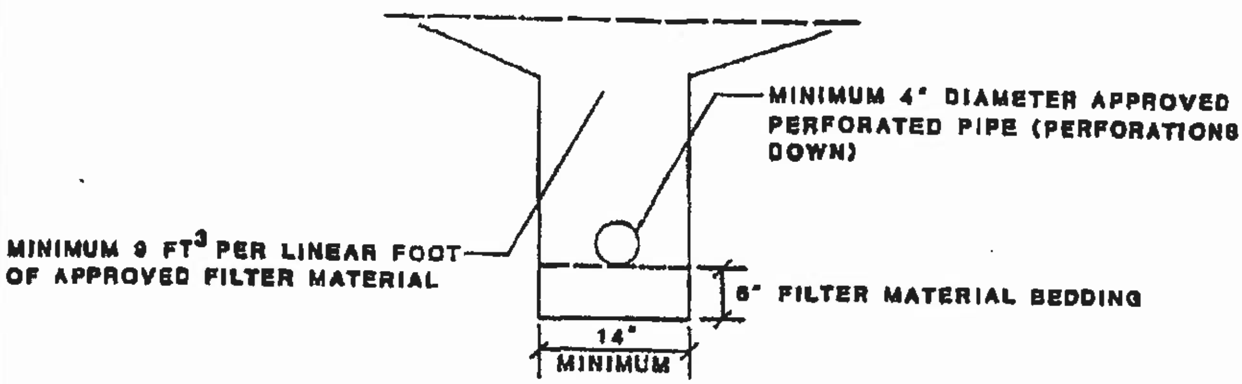
TYPICAL STABILIZATION FILL DETAIL



TYPICAL BUTTRESS FILL DETAIL



DETAIL



FILTER MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

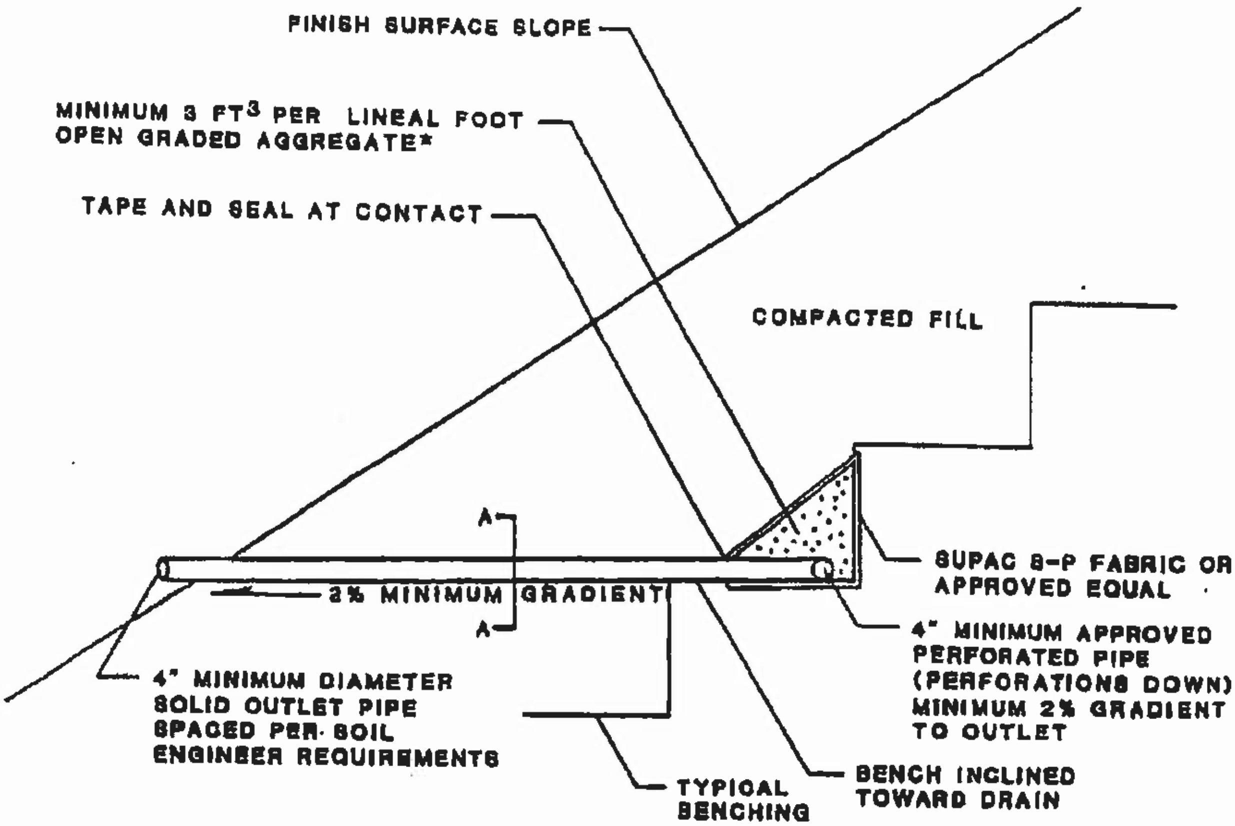
SIEVE SIZE	PERCENTAGE
1"	100
3/4"	90-100
3/8"	40-100
NO.4	25-40
NO.30	5-15
NO.50	0-7
NO.200	0-3

APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi

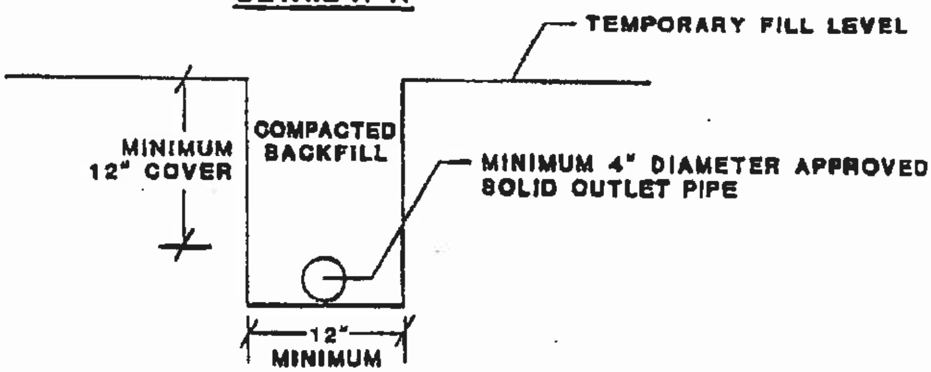
PIPE DIAMETER TO MEET THE FOLLOWING CRITERIA, SUBJECT TO FIELD REVIEW BASED ON ACTUAL GEOTECHNICAL CONDITIONS ENCOUNTERED DURING GRADING

LENGTH OF RUN	PIPE DIAMETER
UPPER 500'	4"
NEXT 1000'	6"
> 1500'	8"

TYPICAL CANYON SUBDRAIN DETAIL



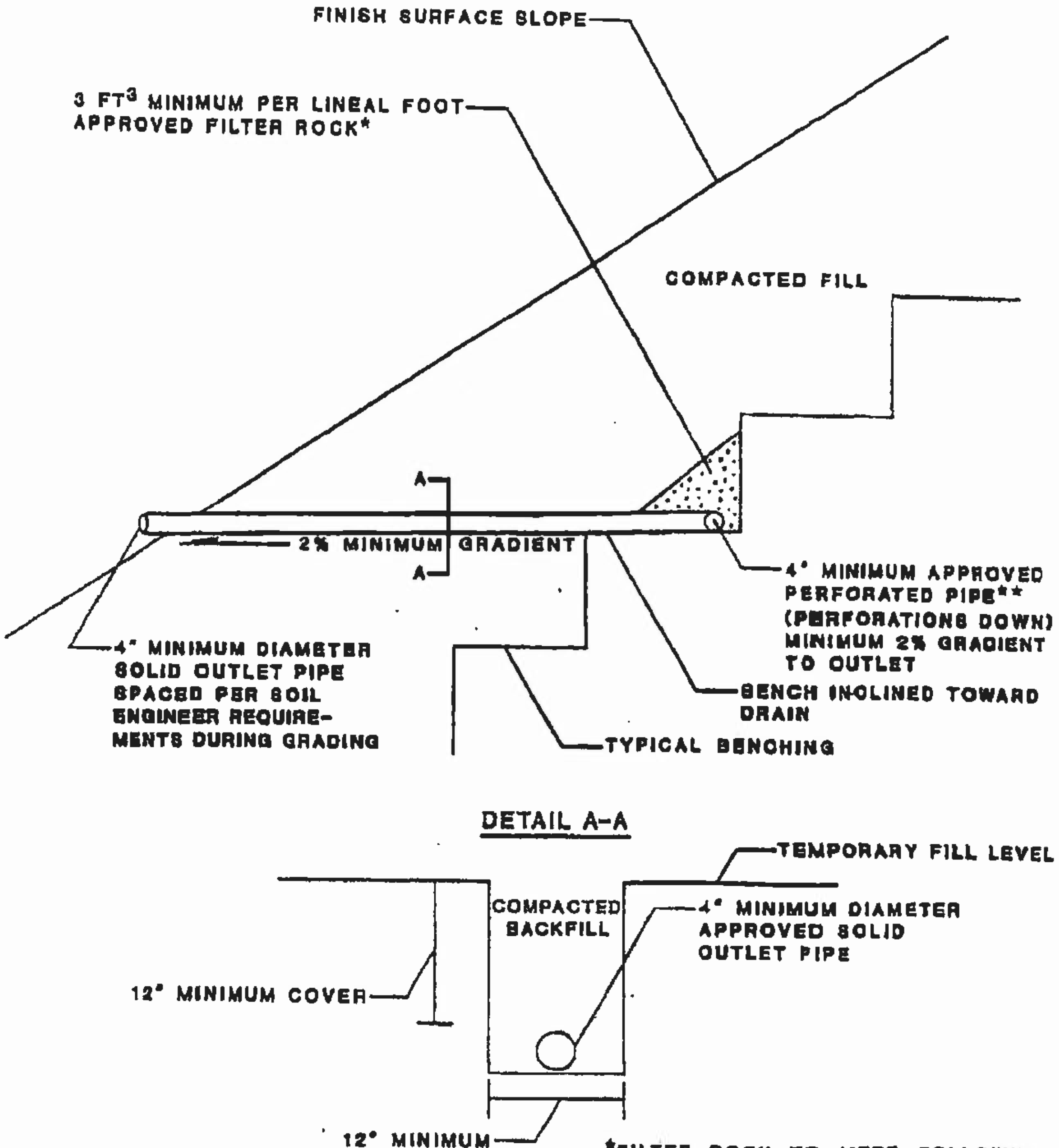
DETAIL A-A



*NOTE: AGGREGATE TO MEET FOLLOWING SPECIFICATIONS OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	100
1"	5-40
3/4"	0-17
3/8"	0-7
NO. 200	0-3

BACKDRAIN DETAIL (GEOFABRIC)



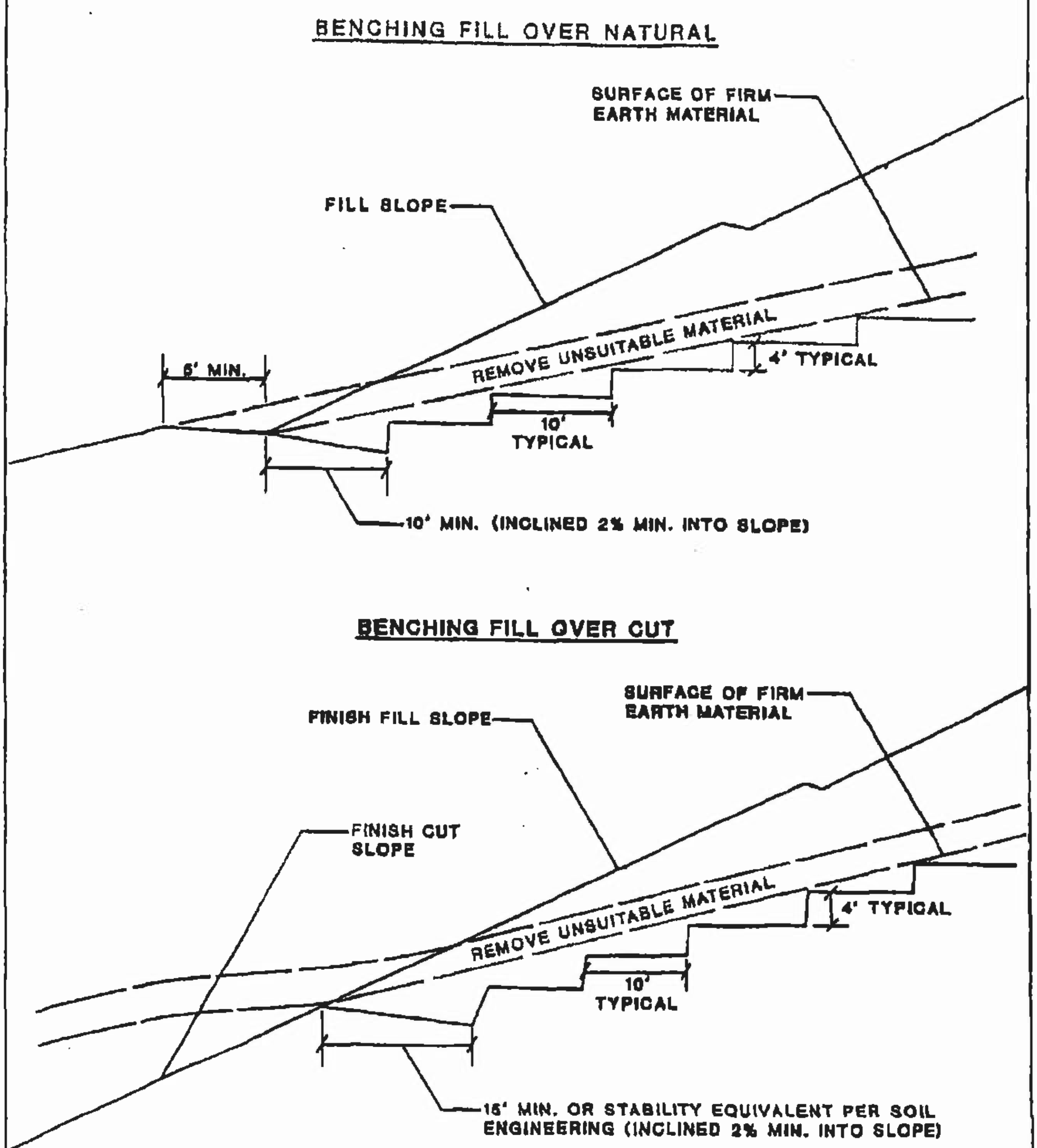
*FILTER ROCK TO MEET FOLLOWING SPECIFICATIONS OR APPROVED EQUAL:

SIEVE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO.4	25-40
NO.30	5-15
NO.50	0-7
NO.200	0-3

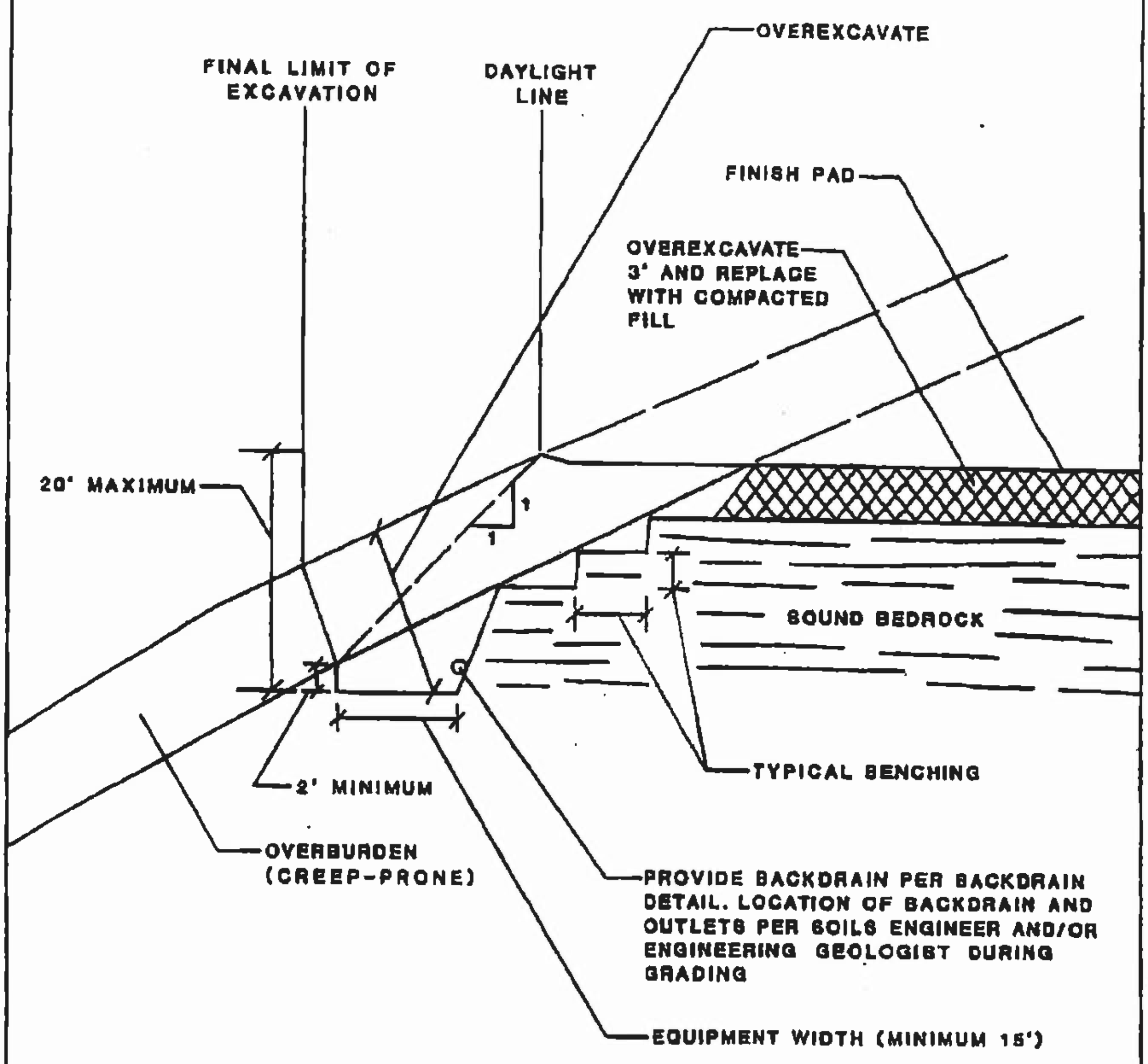
**APPROVED PIPE TYPE:

SCHEDULE 40 POLYVINYL CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 PSI.

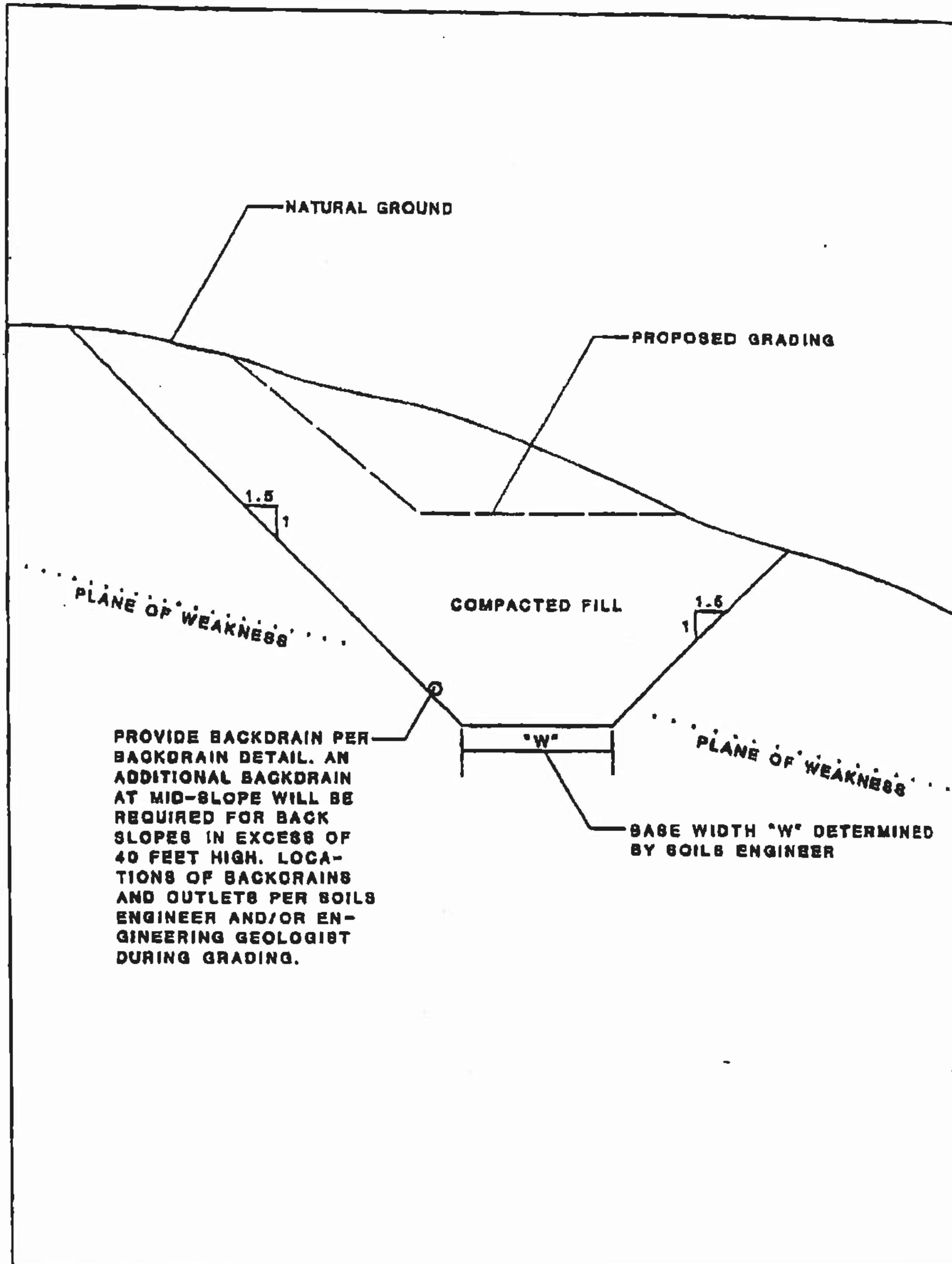
TYPICAL BACKDRAIN DETAIL



BENCHING FOR COMPACTED FILL DETAIL

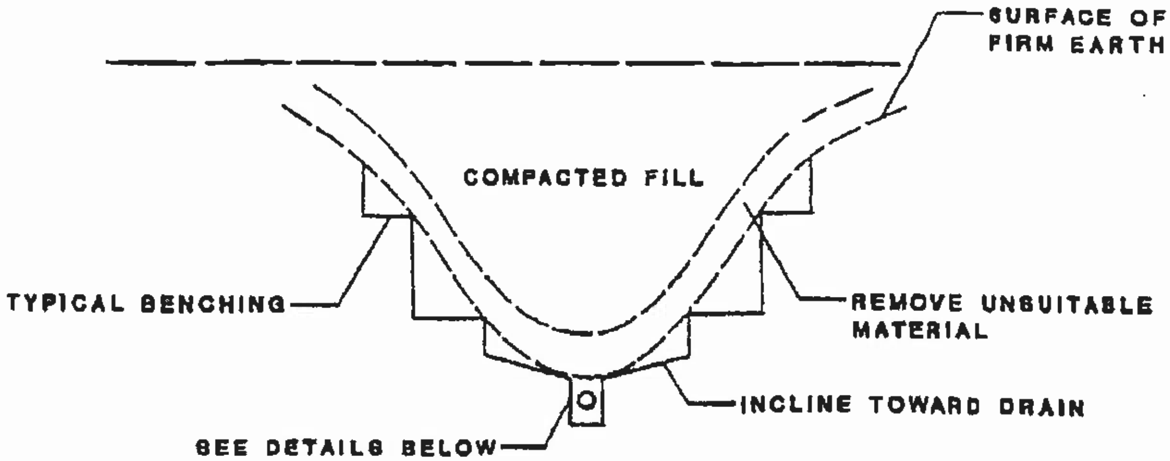


DAYLIGHT SHEAR KEY DETAIL

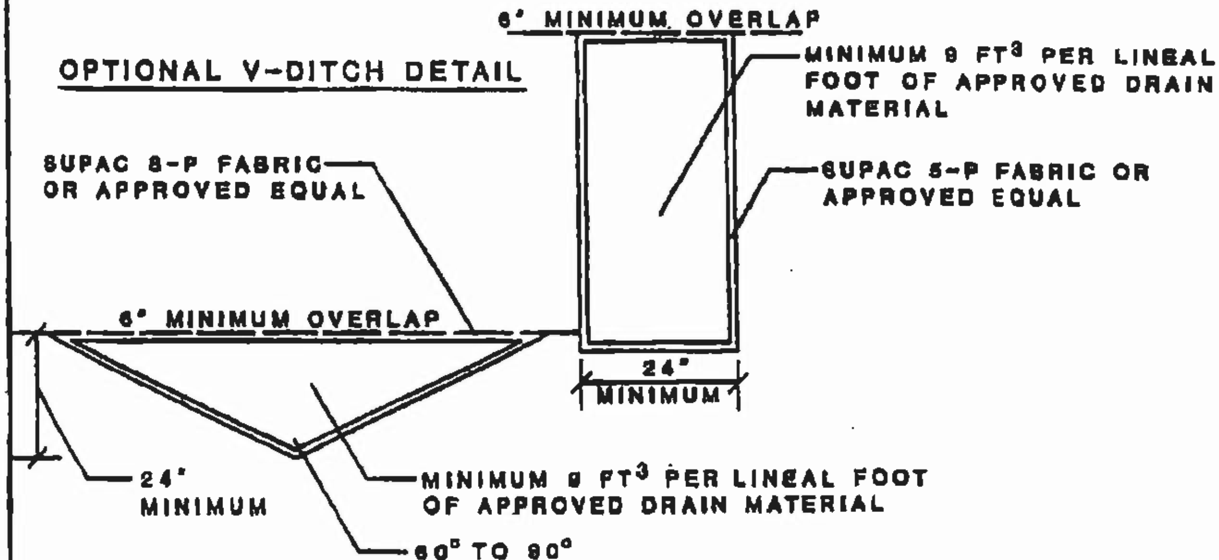


TYPICAL SHEAR KEY DETAIL

CANYON SUBDRAIN DETAILS



TRENCH DETAIL



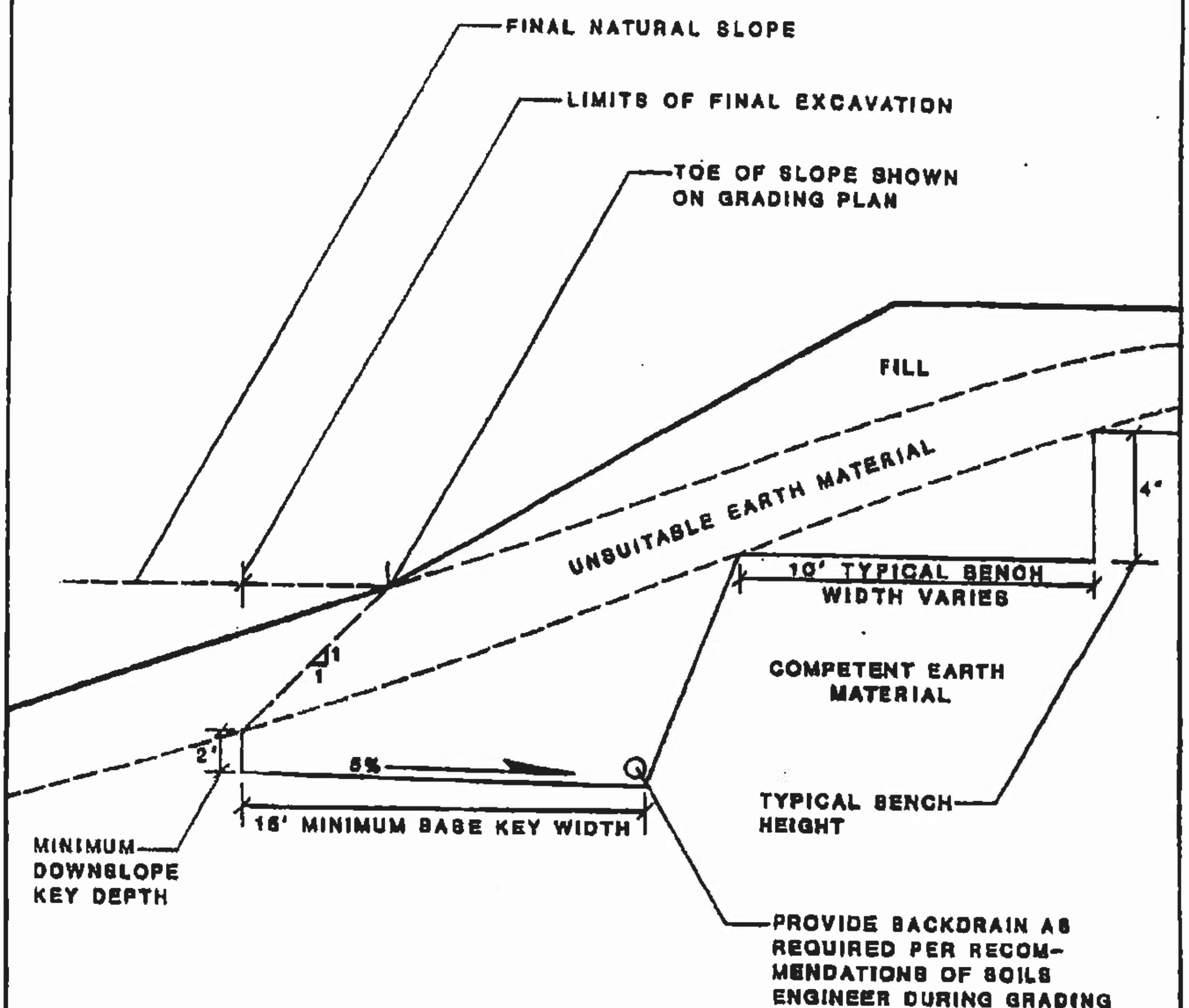
DRAIN MATERIAL TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUAL:

SIEVE SIZE	PERCENTAGE PASSING
1 1/2"	88-100
1"	5-40
3/4"	0-17
3/8"	0-7
NO.200	0-3

ADD MINIMUM 4" DIAMETER APPROVED PERFORATED PIPE WHEN GRADIENT IS LESS THAN 2%

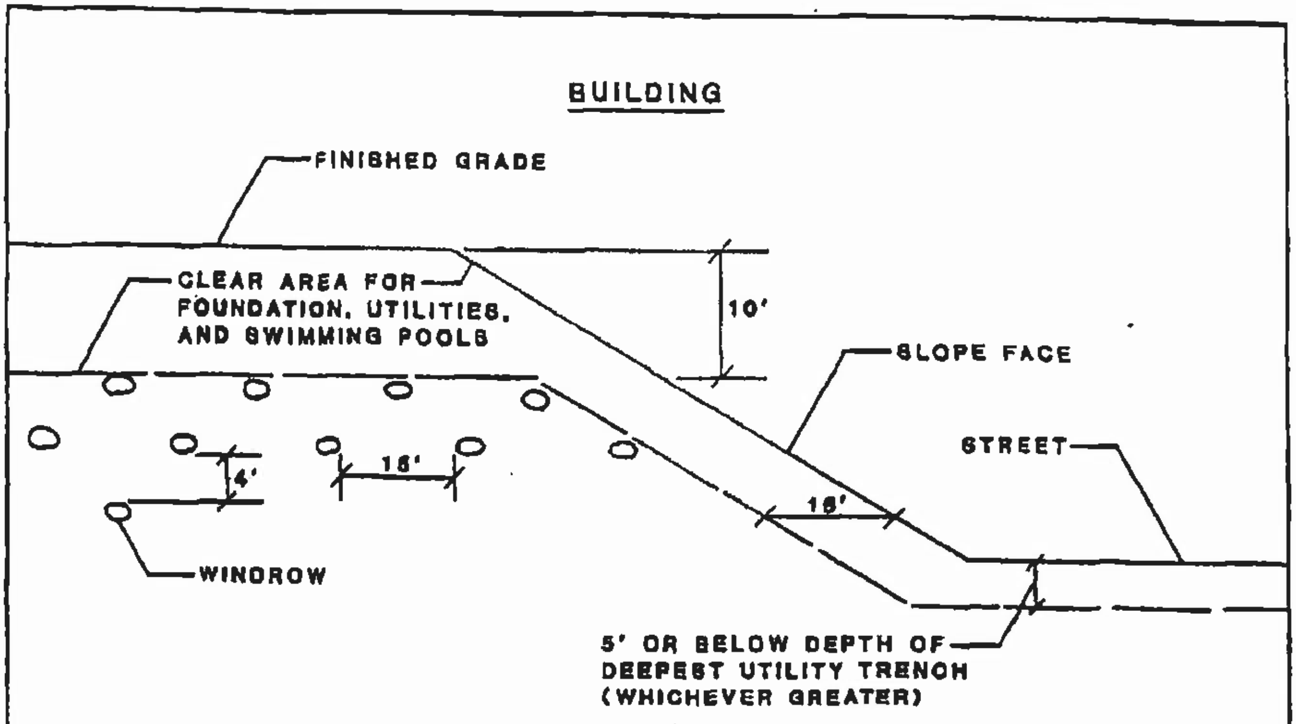
APPROVED PIPE TO BE SCHEDULE 40 POLY-VINYL-CHLORIDE (P.V.C.) OR APPROVED EQUAL. MINIMUM CRUSH STRENGTH 1000 psi.

GEOFABRIC SUBDRAIN

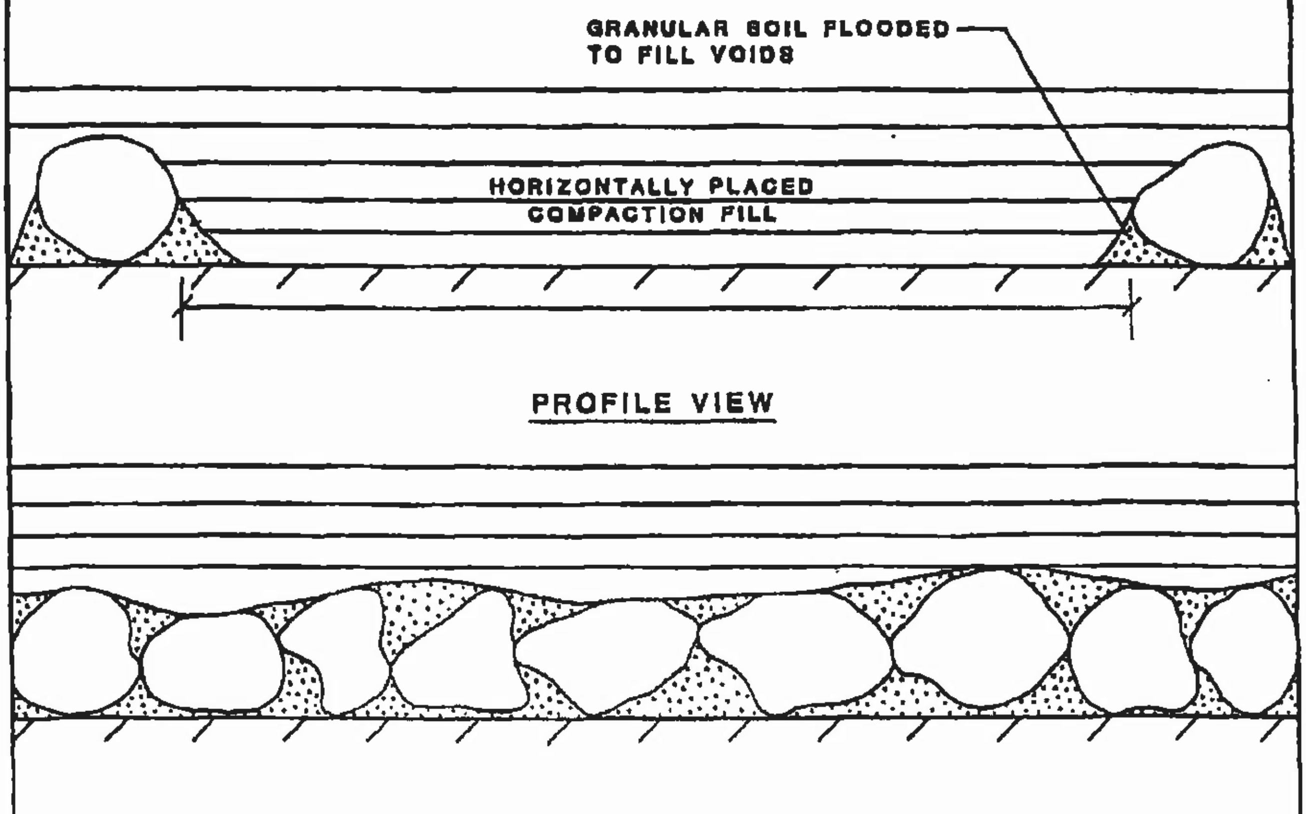


WHERE NATURAL SLOPE GRADIENT IS 5:1 OR LESS, BENCHING IS NOT NECESSARY. HOWEVER, FILL IS NOT TO BE PLACED ON COMPRESSIBLE OR UNSUITABLE MATERIAL.

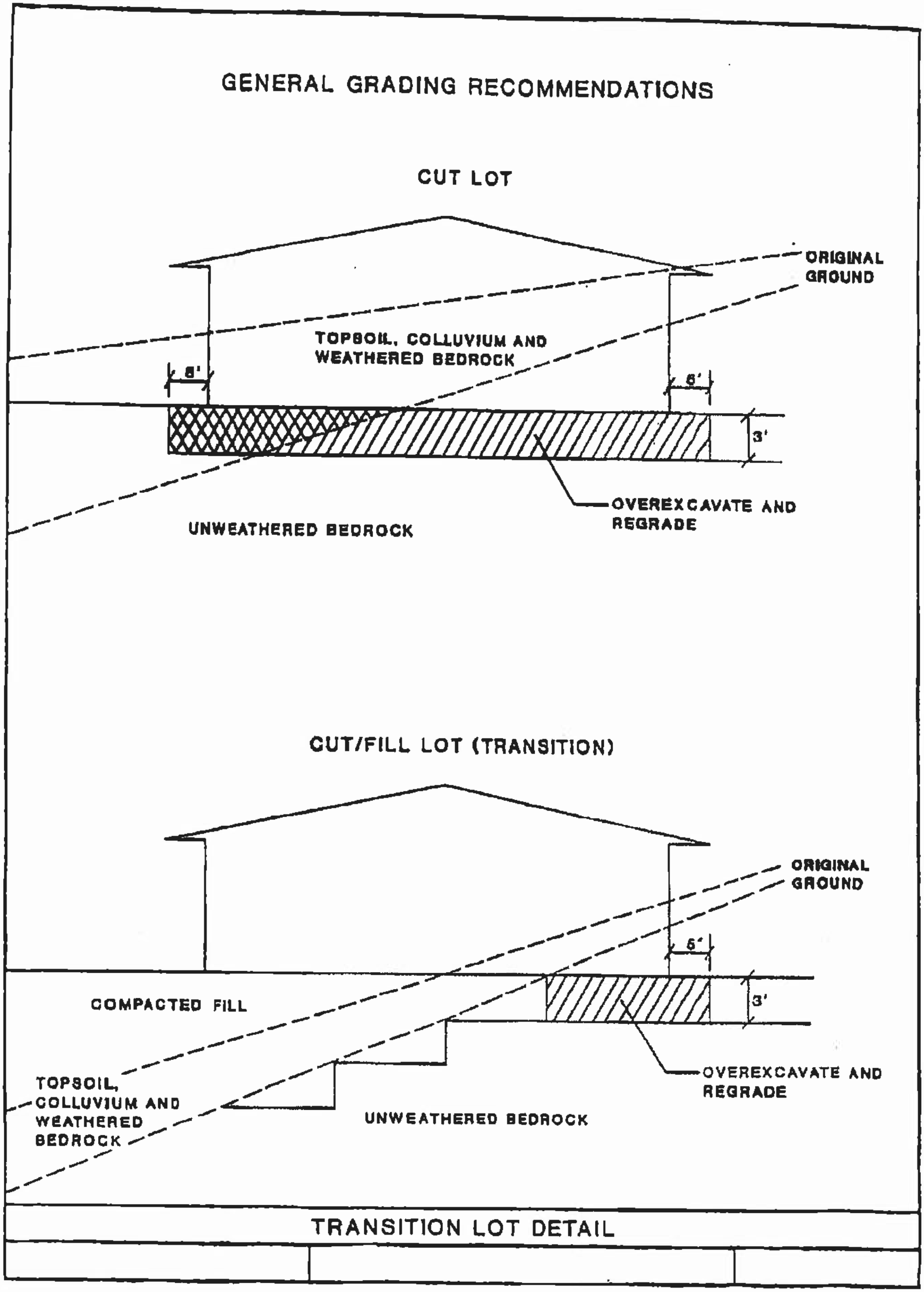
FILL SLOPE ABOVE NATURAL GROUND DETAIL

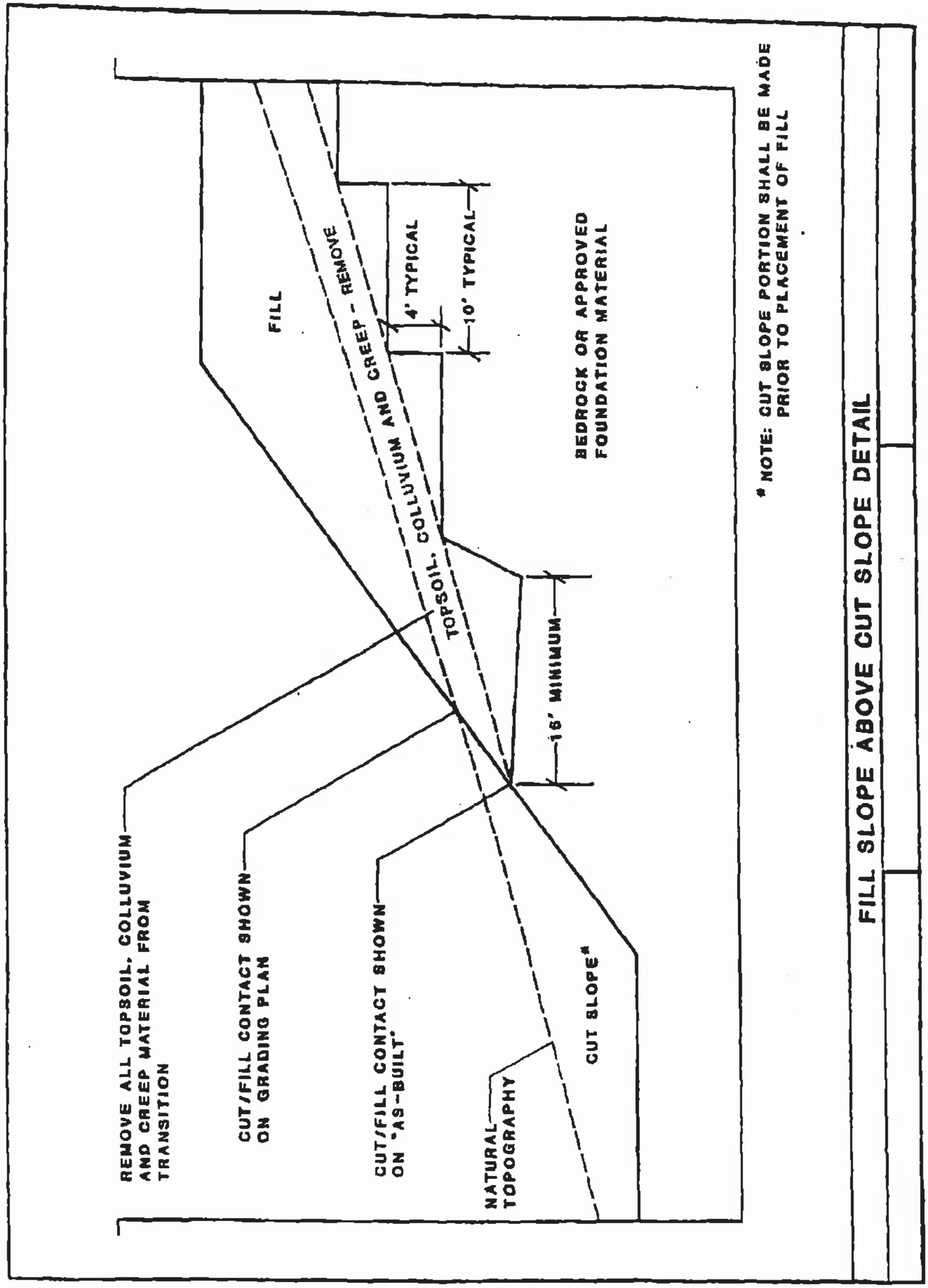


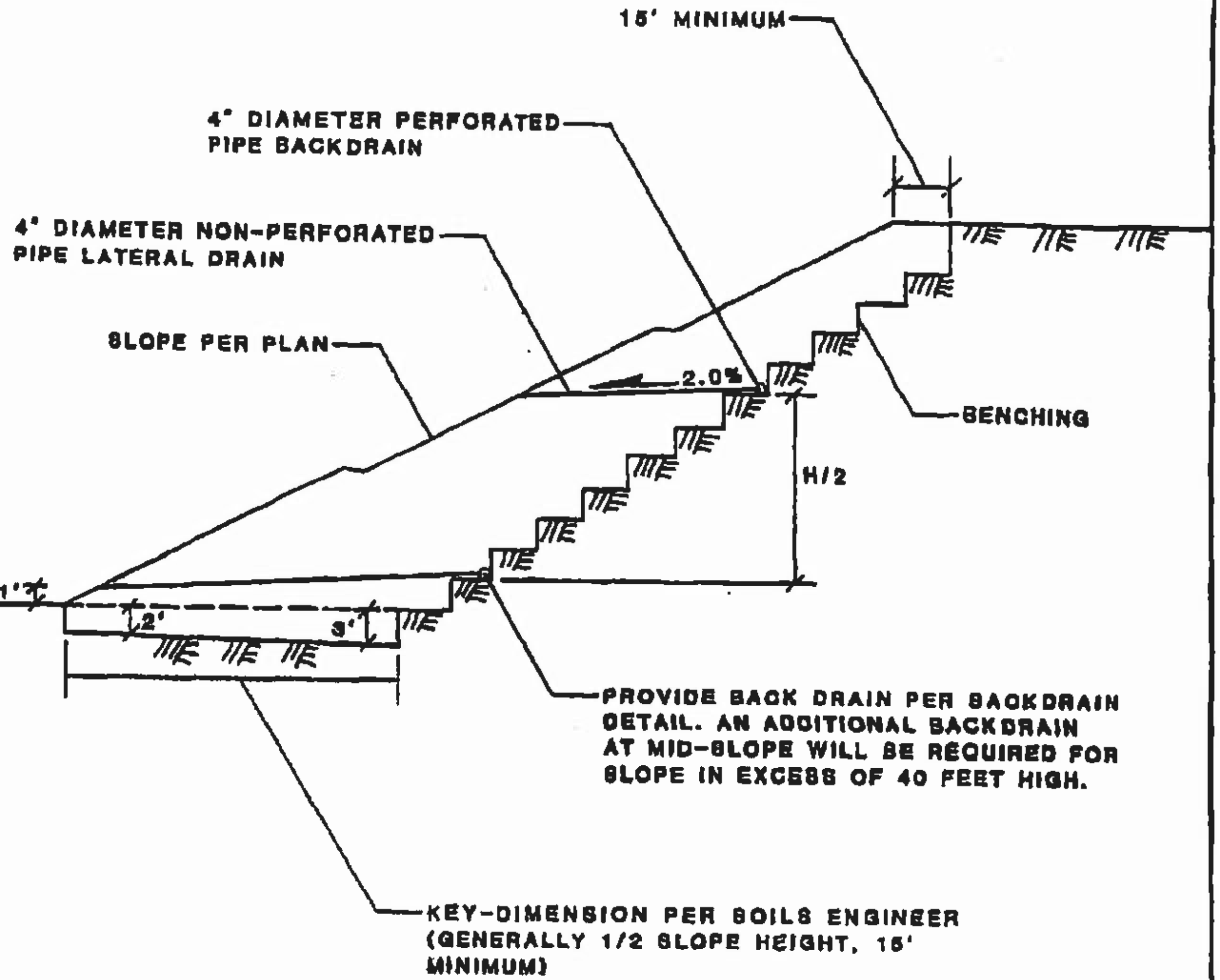
TYPICAL WINDROW DETAIL (EDGE VIEW)



ROCK DISPOSAL DETAIL


GENERAL GRADING RECOMMENDATIONS
CUT LOT
ORIGINAL GROUND
TOPSOIL, COLLUVIUM AND WEATHERED BEDROCK
5'
5'
3'
OVEREXCAVATE AND REGRADE
UNWEATHERED BEDROCK
CUT/FILL LOT (TRANSITION)
ORIGINAL GROUND
5'
3'
COMPACTED FILL
OVEREXCAVATE AND REGRADE
TOPSOIL, COLLUVIUM AND WEATHERED BEDROCK
UNWEATHERED BEDROCK
TRANSITION LOT DETAIL


FILL SLOPE ABOVE CUT SLOPE DETAIL
REMOVE ALL TOPSOIL, COLLUVIUM AND CREEP MATERIAL FROM TRANSITION
CUT/FILL CONTACT SHOWN ON GRADING PLAN
CUT/FILL CONTACT SHOWN ON "AS-BUILT"
NATURAL TOPOGRAPHY
CUT SLOPE*
FILL
TOPSOIL, COLLUVIUM AND CREEP - REMOVE
4' TYPICAL
10' TYPICAL
15' MINIMUM
BEDROCK OR APPROVED FOUNDATION MATERIAL
* NOTE: CUT SLOPE PORTION SHALL BE MADE PRIOR TO PLACEMENT OF FILL



TYPICAL STABILIZATION FILL DETAIL

APPENDIX E

PREVIOUSLY ISSUED SOILS REPORT

GEOTECHNICAL INVESTIGATION

CLUB ESTATES SUBDIVISION
PALA ROAD
PAUMA VALLEY, CALIFORNIA

JOB NO. 05-22

JULY 11, 2005

WESTERN
SOIL AND FOUNDATION ENGINEERING, INC.

WESTERN
SOIL AND FOUNDATION ENGINEERING, INC.

PHONE: (760) 746-3553
FAX: (760) 746-4912

423 HALE AVENUE
ESCONDIDO, CALIFORNIA 92029

July 11, 2005

V.O. Pauma Corporation
c/o Ms. Cynthia Eldred, Esq.
517 Fourth Avenue, Suite 103
San Diego, CA 92101

Project: Job No. 05-22
Club Estates Subdivision
Pala Road
Pauma Valley, California

Subject: Report of Geotechnical Investigation

Dear Ms. Eldred:

In accordance with your request, we have completed a geotechnical investigation for the proposed project. We are presenting to you, herewith, our findings, conclusions and recommendations for the development of this site.

The findings and conclusions of this study indicate that the site is suitable for development if the recommendations provided in the attached report are incorporated into the design and construction of this project.

If you have any questions after reviewing the findings and recommendations contained in the attached report, please do not hesitate to contact this office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,

WESTERN SOIL AND FOUNDATION ENGINEERING, INC.

Vincent W. Gaby, CEG 1755, Expires 7/31/05
Engineering Geologist

Dennis E. Zimmerman, C 26676, GE 928, Expires 3/31/06
Geotechnical Engineer

Attachments

Distribution: (5) Addressee
(1) Addressee (Unbound)

VWG:DEZ/kmg

GEOTECHNICAL INVESTIGATION

CLUB ESTATES SUBDIVISION
PALA ROAD
PAUMA VALLEY, CALIFORNIA

Prepared For:

V.O. Pauma Corporation
c/o Ms. Cynthia Eldred, Esq.
517 Fourth Avenue, Suite 103
San Diego, CA 92101

JOB NO. 05-22

JULY 11, 2005

WESTERN
SOIL AND FOUNDATION ENGINEERING, INC.

TABLE OF CONTENTS

Page

Introduction and Project Description 1

Project Scope 2

Findings 3
- Site Description 3
- Subsurface 4
- Tonalite 4
- Alluvium 4
- Rippability 5
- Groundwater 5

Geologic Hazards 6
- Faults and Seismic Hazards 6
  - Seismicity of Major Faults Table 8
  - Design Earthquake Table 8
- Liquefaction 9
- Landslides and Slope Stability 9
- Flood Hazard 10

Recommendations and Conclusions 11
- Site Preparation 11
  - Existing Soil 11
  - Geogrid Reinforced Soils 12
  - Remedial Grading Beneath Streets 13
  - Expansive Soil 13
  - Soil Suitability 14
  - Soil Shrinkage 14
  - Imported Fill 15
  - Cut Slopes 15
  - Fill Slopes 15
  - Subdrains 16
  - Surface Drainage 17
  - Earthwork 18

TABLE OF CONTENTS – Con't.

Page

Foundation Recommendations....................19
Seismic Site Categorization....................19
Footings....................19
Footings Established on Compacted Fill Table....................19
Concrete Slabs-On-Grade....................20
Slab-On-Grade Bedding....................21
Impermeable Membrane....................21
Transition Areas....................22
Lateral Resistance....................22
Lateral Resistance Values Table....................22
Footing Observations....................23
Pavement Recommendations....................23
Preliminary Flexural Pavement Design....................23
Base Materials....................24
Subgrade Preparation....................24

Field Explorations....................25

Laboratory Testing....................26

Plan Review....................26

Limitations....................26

ATTACHMENTS

Plate No. 1	Site Plan (In back pocket)
Plate No. 1A	Geologic Cross Section (In back pocket)
Plate No. 2	Unified Soil Classification Chart
Plate No. 3 through Plate No. 14	Exploratory Excavation Logs
Plate No. 15 through Plate No. 17	Laboratory Test Results
Plate No. 18	Table I
Plate No. 19	Fill Slope Key
APPENDIX I	Specifications for Construction of Controlled Fills
APPENDIX II	References

GEOTECHNICAL INVESTIGATION

CLUB ESTATES SUBDIVISION
PALA ROAD
PAUMA VALLEY, CALIFORNIA

Introduction and Project Description

This report presents the results of our geotechnical investigation performed on the above referenced site. The purpose of this investigation was to evaluate the existing surface and subsurface conditions from a geotechnical perspective and to provide recommendations for grading, foundation design, floor slab support and furnish a preliminary pavement design for interior streets.

As currently proposed, the project will be the development of a residential subdivision consisting of 30 residential lots. Several private interior streets will provide access through the development from Pala Road (State highway 76). According to the preliminary conceptual plans, maximum cuts and fills will be on the order of 10 feet. New embankments will also likely be on the order of 10 feet in vertical height.

Building plans were not available, however, it is anticipated that the residences will consist of 1- or 2-story, wood-framed structures supported on continuous and square pad spread footings with concrete slab-on-grade floors.

The recommendations presented herein are based on the conceptual drawings and verbal descriptions provided. We should be allowed the opportunity to amend our recommendations, if necessary, after our review of final plans. If any future development deviates significantly from our understanding of the project described above, we should be consulted for further recommendations.

The site configuration and the approximate locations of our subsurface explorations are shown on the enclosed Site Plan, Plate No 1, located in the back pocket of this report.

Project Scope

This investigation consisted of a surface reconnaissance coupled with a subsurface exploration. Representative samples of soil material were obtained from the site and returned to our laboratory for observation and testing. The results of the field and laboratory data collected are presented in this report.

Specifically, the intent of this investigation was to:

a) Explore the subsurface conditions to the depths that could be influenced by the proposed construction;

b) Evaluate, by laboratory tests, the pertinent static physical properties of the various soil and rock stratigraphic units which could influence the development of this project;

c) Describe the site geology, including potential geologic hazards and their effect upon the proposed development;

d) Provide recommendations for site preparation and grading;

e) Furnish soil parameters for foundation design, including bearing capacity, estimated settlements, lateral pressures, and expansion potential of the on-site soils; and

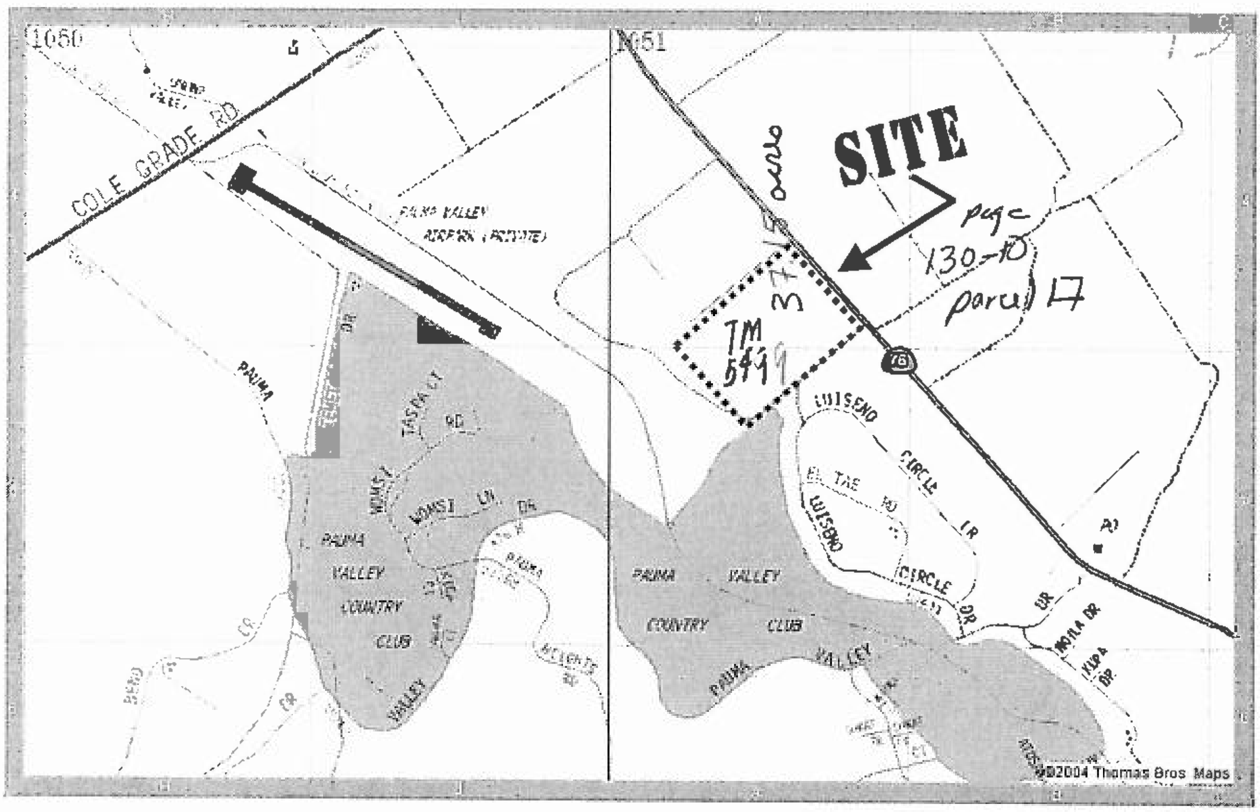
f) Present pavement design recommendations for the proposed interior street.

This report has been prepared for the V.O. Pauma Corporation and their design consultants to be used in the evaluation of the referenced site. This report has not been prepared for use by other parties, and may not contain sufficient information for purposes of other parties or other uses. The information in this report represents professional opinions that have been developed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the professional advice included in this report.

Findings

Site Description: The project site is located north of Luiseno Circle Drive and west of Pala Road, in the community of Pauma Valley, county of San Diego, California. The site vicinity can be found in the south half of grid A-4 and the north half of grid A-5, page 1051 of the Thomas Brothers Guide for San Diego County, 2004 edition.

1051 A-5 book 130



The proposed development site is irregular in configuration and encompasses approximately 30 acres. It is bounded to the north by single-family residences, to the west and south by agricultural property, and to the east by a single-family residence. Approximately 1,000 feet front Pala Road along the east property line.

The site terrain varies from moderately steep to gently inclined. Elevations range from 884 feet above mean sea level (m.s.l.) along Pala Road to approximately 795 feet m.s.l. at the southwest side of the development. Drainage is by sheet flow towards the west into the San Luis Rey River.

Improvements observed on the site at the time of our investigation included two wells and an asphalt-paved road which ran along the southern and western perimeter of the property. An existing single-family residence at the northwest corner of the site may be separated from the project by a boundary adjustment. Vegetation across the development site consisted of orange groves along the eastern one-third of the property and wild grasses across the remaining two-thirds.

Subsurface Conditions: The subject site is mantled by a thick sequence of alluvium. This alluvium represents coalescing sediments of the distal portions of an alluvial fan and stream terrace deposits of the San Luis Rey River. On the distant slopes west and east of the development area, outcrops of granitic rock occur. Although not exposed in any of our excavations, this bedrock material likely underlies the alluvium at depths in excess of 50 feet. Each unit is described below in order from oldest to youngest.

Tonalite: Outcrops of granitic rock are exposed on the hillsides both to the west and east of the subject site. These outcrops are dark gray, medium to coarse grained and spherically weathered. Although not encountered within our exploratory excavations, the bedrock materials are expected to occur beneath the proposed development at depths greater than 50 feet.

Alluvium: The alluvial sediments consist of relatively clean to silty, and clayey, fine, medium and coarse grained sands. Thick conglomerate beds complete the sequence. The sediments are poorly to moderately consolidated and horizontally bedded. Their color ranges from orangish-brown, to brown when more clay and silt are present, to grayish-brown and gray when the deposits are relatively clean.

The conglomerate is composed of pebble- to boulder-sized, angular to sub-rounded, granitic (tonalite and gabbro) and metamorphic (mica-schist and gneiss) rocks. It occurs both clast-supported (rock-to-rock contact) and/or supported in a matrix of slightly silty sand.

The alluvial sediments are present on the surface of the site and extend beyond the vertical limits of our explorations.

Rippability: Ten (10) exploratory trenches were excavated with little difficulty using a Case 580 backhoe. These trenches ranged from 9½ to 15½ feet in depth. In addition, two (2) small diameter borings were advanced to depths of 12 to 50 feet using a truck-mounted drill rig. Refusal was encountered in boring B-1 at a depth of 12 feet. For the purposes of this study, refusal is defined as the inability of the exploratory equipment to excavate the bedrock materials. It is likely that this refusal occurred on a large cobble or boulder within the narrow diameter boring.

It is our opinion that heavy-duty equipment, similar to a D-9 with a single tooth ripper, could excavate these materials to the depths explored. However, it is possible that bedrock materials or large boulders that require blasting or pneumatic chipping may be encountered at locations or depths that were not explored.

Groundwater: Free groundwater was not observed in any of the exploratory excavations. The recently completed precipitation year (July 2004 through June 2005) recorded rainfall totals that were well above average.

The site is situated adjacent to a narrow drainage basin. Fluctuations of subsurface water will be affected by variations in annual precipitation and local irrigation.

Therefore, consideration should be given to appropriate surface and subsurface drainage systems, as recommended further in this report.

Geologic Hazards

Faults and Seismic Hazards: The numerous fault zones in southern California include active, potentially active, and inactive faults. Active faults are those which display evidence of movement within Holocene time (from the present to approximately 11 thousand years). Faults that have ruptured geologic units of Pleistocene age (11 thousand to 2 million years) but not Holocene age materials, are considered potentially active. Inactive faults are those which exhibit movement that is older than 2 million years. According to available published information, there are no known active or potentially active faults which intercept the project site.

The site is not located within an Alquist-Priolo Special Studies Zone. Therefore, the potential for ground rupture at this site is considered low. There are, however, several faults located in such close proximity that movement associated with them could cause significant ground motion at the site. These include the Elsinore fault zone, which lies approximately 3 miles to the northeast; the San Jacinto fault zone, located approximately 26 miles to the northeast; the Rose Canyon fault zone, situated 29 miles to the west (offshore); and the San Andreas fault zone, located 52 miles to the east. Of these, the Elsinore fault zone would likely have the greatest impact on the site.

The Elsinore fault zone is a predominantly northwest-striking group of faults which extend from the Mexican border northward along the west flank of Palomar Mountain, to the city of Corona in Riverside County. The Elsinore fault zone is considered active. Within the regional area of the project site, the Elsinore fault zone is characterized by right lateral strike-slip faulting (Kennedy 1977). Neotectonic studies by Vaughan and Rockwell (1986) within the Agua Tibia Mountains identify thrust faulting north of Pauma Valley near Frey Creek. They had estimated slip rates of 3-6 millimeters per year for that portion of the Elsinore fault zone. Based on their estimates, the recurrence interval for a magnitude 6 event would be from 50 to 90 years; and for a magnitude 7 event, the recurrence interval would be 250-450 years. Relative to other regional fault zones (e.g., San Jacinto, San Andreas) the frequency of seismic events associated with the Elsinore fault zone has historically been low. The frequency of seismic events apparently increases southward along the fault zone.

The table below presents the maximum credible and maximum probable earthquake magnitudes, and estimated peak accelerations anticipated at the site. These accelerations are based on the assumption that the maximum probable earthquake occurs on specific faults at the closest point on that particular fault to the site. The maximum credible earthquake is defined as the maximum earthquake that appears to be reasonably capable of occurring under the conditions of the presently known geologic framework. The probability of such an earthquake occurring during the lifetime of this project is considered low. The maximum probable earthquake is considered to be an event having a return period of 100 years.

Seismicity of Major Faults

Fault	Distance (Miles)	Maximum Credible Magnitude (Richter)	Maximum Probable Magnitude (Richter)	Estimated Bedrock Acceleration (1) (g)
Coronado Banks	39	7.6 L (2)	6.7	0.07
Elsinore	3	7.5 L (3)	6.6	0.59
Rose Canyon	29	7.0 L (2)	5.9	0.07
San Andreas	52	8.3 L (3)	8.0	0.11
San Jacinto	26	7.8 L (3)	7.0	0.16

L = Local Magnitude

(1) Seed and Idriss, 1982
(2) Slemmons, 1979
(3) Greensfelder, C.D.M.G. Map Sheet 23, 1994

The preceding table suggests that the Elsinore fault zone could have a predominant influence on the site. The postulated design earthquake and ground accelerations are presented in the table below.

Design Earthquake

Fault Zone Source	Maximum Credible Magnitude (Richter)	Peak Ground Acceleration (g)	*Sustained Acceleration (g)
Elsinore	6.6	0.59	0.38

*Sustained Acceleration considered
65% of peak ground acceleration

Liquefaction: The potential for seismically induced liquefaction is greatest where shallow groundwater and poorly consolidated, well-sorted, fine grained sands and silts are present. Liquefaction potential decreases with increasing density, grain size, clay content and gravel content. Conversely, liquefaction potential increases as the ground acceleration and duration of seismic shaking increase.

Groundwater was not observed within any of the exploratory excavations. The underlying geologic unit primarily consists of poorly to moderately consolidated, silty to clayey sands, interbedded with pebble/cobble conglomerate. Although zones of well-sorted sands were encountered in our explorations, they were interbedded with significantly thick, massively bedded conglomerate beds. Additionally, groundwater is not anticipated to occur at shallow depths.

Based on the conditions observed, it is our professional opinion that the site has a low potential for being impacted from seismically induced liquefaction.

Landslides and Slope Stability: No evidence indicative of deep-seated landslides was observed during our investigation. There were no remolded clay seams, sheared zones or adversely oriented geologic structures encountered in the exploratory excavations. The majority of the proposed development area is situated on moderately steep to very gently inclined topography. However, a very steep slope, 25 feet to 35 feet in height, exists along the western edge of the project. Based on our evaluation, it is our professional opinion that this slope should exhibit a factor of safety greater than 1.5 for gross stability.

Due to the generally cohesionless nature of some of the exposed soils, it is expected that this steep slope may experience surficial slumping and soil creep. We recommend that a setback of at least 50 feet be maintained between the top of the existing bluff and any new structures.

Preliminary conceptual drawings indicate that newly created slopes will not exceed 10 feet in height. Observation of excavations made during and after grading will be important to identify potential shallow slope failures. It is our opinion that the potential for slope failure on this project is low if the earthwork and construction are performed in accordance with the recommendations contained in this report.

Flood Hazard: The proposed development will be at or above an elevation of 800 feet m.s.l. Based on the available information, the perimeter elevation of the "100 year" flood plain for that portion of the San Luis Rey River adjacent to the property ranges from approximately 770 feet m.s.l. at the southwest side of the site to approximately 760 feet m.s.l. near the northwest side of the site. The "100 year flood" is a term which describes a flood estimated to occur on an average of once in 100 years or a 1% probability of occurrence in any given year.

Based on our review of this information and the proposed grading design, it is our opinion that the probability of the subject site being inundated by flooding is low.

There is the potential of the site being impacted by run-off via the shallow arroyos which intersect the eastern side of the property. It is anticipated that the adverse effects of storm run-off would be reduced by drainage improvements and grading associated with the proposed site work as designed by the Project Engineer.

Recommendations and Conclusions

Site Preparation

Existing Soil: The overburden soils (poorly consolidated alluvium) encountered during our subsurface exploration are not considered suitable for the support of foundations, floor slabs or new fill in their present condition. To provide more uniform support for the proposed structures and prior to the placement of any new fill, we recommend that any existing fill, poorly consolidated alluvium or otherwise unsuitable material be completely removed to firm, undisturbed, natural ground at locations where improvements are planned.

The horizontal limits of removal and recompaction shall include the entire areas of proposed structures, pavement, hardscape, fill or any proposed fill slopes. All soil removal and replacement should extend at least 8 feet beyond the footprint of any features as described above, and shall be accomplished in accordance with the earthwork and foundation recommendations presented in this report.

Based on the results of our field explorations, it appears that the depth of removal may vary from 6 to greater than 10 feet. Table I (Plate No. 18) of this report presents anticipated removal depths in the area of our subsurface explorations. Thicker and/or less competent materials may be encountered at locations that were not explored. Unsuitable soils that occur beneath areas to receive retaining walls, asphalt or concrete pavements, driveways, patio slabs or sidewalks shall be treated similarly.

At locations where competent soils occur at depths greater than 10 feet below existing grade, alternative earthwork recommendations may be employed. These are presented in the sections that follow in this report.

Due to the cohesionless nature of the on-site soils, all fill shall be compacted to at least 95% of its maximum dry density as determined by ASTM D1557-00. The moisture content at the time of compaction should be within 2% of optimum for granular soils and between 2% and 4% over optimum for clayey materials.

If groundwater is encountered during the removal and recompaction of the soil, or if difficulty is experienced in achieving the minimum of 95% relative compaction (ASTM D1557-00), then this office shall be consulted for further recommendations.

Geogrid Reinforced Soils: At locations where conventional removal and recompaction depths may exceed 10 feet, the following remedial earthwork methods using geogrid reinforcement can be applied. To reduce the potential for differential settlement beneath proposed structures, we recommend that the existing soils be removed to a depth of at least 6 feet below finish pad elevation. The bottom of the excavation should be ripped to a depth of at least 12 inches, brought to near optimum moisture content and recompacted to no less than 95% of its maximum dry density as determined by ASTM D1557-00. Where fill slopes are greater than 3 feet in vertical height, additional removal and recompaction should be performed prior to the installation of the geogrid. This removal should incorporate the fill slope keyway as described in the section entitled "Fill Slopes" of this report. Removal depths should extend to a depth of at least 5 feet below existing grade within the keyway. At the bottom of the resulting excavation, a layer of geogrid such as Tensar BX6100 or an approved equivalent should be placed. The geogrid should be installed according to the manufacturer's specifications.

A one-foot-thick layer of on-site soil material shall be placed on the geogrid. The soil material shall be compacted to no less than 95 percent of its maximum dry density (ASTM D1557-00). Two additional intervals of geogrid, each separated by a one-foot-thick layer of compacted fill, should be placed in the building pad removal excavation. From the top of the last geogrid layer to the building pad finish grade, un-reinforced soil material shall be placed and compacted to no less than 95 percent relative compaction (ASTM D1557-00).

This method of removal and recompaction, utilizing geogrid reinforcement, shall extend no less than 10 feet horizontally beyond the footprint of any structure.

Due to the narrow zone between pad finish grade and the top geogrid layer, it is imperative that plumbing and underground utilities be designed and constructed to avoid conflict with the geogrid. It is recommended that flexible utility connections be used at the points of entry into the building footprint.

Remedial Grading Beneath Streets: Existing soils beneath private roads, driveways, hardscape and pavements should be removed to a depth of at least 5 feet below finish surface. The on-site soil, minus any debris, organic material or oversized rock (greater than 12 inches in maximum dimension), may be used as controlled fill. All fill shall be compacted to at least 95% of its maximum dry density (ASTM D1557-00).

Expansive Soil: Detrimentally expansive soils (Expansion Index of 21 or greater) were not encountered during our subsurface exploration. The majority of materials observed in our investigation consisted of poorly to moderately well graded sands with pebbles and cobbles, deposited by a high-energy alluvial environment. This depositional environment is typically not conducive to the accumulation of expansive clays or silts. Nevertheless, the geotechnical consultant must be informed if suspected expansive soils are exposed during grading or construction.

Potentially expansive soil should not be placed within 4 feet of finish grade for conventional foundations. Expansive soils should not be used as wall backfill or within 2 feet of finish subgrade in concrete pavements or hardscaped areas.

Soil Suitability: With the exception of oversized clasts (rocks larger than 12 inches in longest dimension), the soils encountered in the exploratory excavations are suitable for use as compacted fill. Thick beds of cobble conglomerate occur at several of the exploratory locations. It is expected that on-site screening will be necessary to remove oversized materials. Rocks larger than 12 inches should be segregated from the fill and disposed of in an approved, legal manner. Oversized rocks may be used on-site for landscaping, slope armor or buried in non-structural fills.

Rocks larger than 6 inches in maximum dimension should not be placed within 3 feet of finish grade on any building pad, nor should they be used in utility or plumbing trench backfill.

The evaluation of the corrosion potential of on-site soil was not within the scope of our work. The corrosion potential of soils that may be in contact with foundations or buried ferrous metals shall be evaluated during rough grading and after import materials have been selected.

Soil Shrinkage: Based on our limited determination of the density of on-site materials and the anticipated recompaction of these materials to 95% maximum dry density (ASTM D1557-00), we have estimated soil shrinkage to be on the order of 15 to 20 percent. It should be noted that this estimation is preliminary and could change due to variations in the expected conditions. These variations could include, but would not be limited to:

- Soils that are recompacted substantially higher than 95% maximum dry density;
- Lenses of in-place sediments that are significantly more consolidated or significantly less consolidated than originally detected; and
- Volume loss due to extracted oversized rock.

Imported Fill: Imported fill, if required at this site, shall be approved by our office prior to importing. We should be given ample time to sample and test potential import soil prior to its delivery to this site. Imported fill material shall have an Expansion Index of 20 or less with not more than 25 percent passing the No. 200 U.S. standard sieve.

Cut Slopes: According to the verbal information provided, cut slopes could approach maximum vertical heights on the order of 10 feet. In general, the near surface soil materials are poorly consolidated. It is our professional opinion that slopes excavated into the alluvial soils at an inclination of 2:1 (horizontal to vertical) could be subject to shallow seated slope failure.

We recommend that all proposed cut slopes be reconstructed as fill slopes. Fill slope recommendations are presented in the following section of this report. As an alternative, cut slopes that do not exceed 4 feet in vertical height may be excavated into the alluvial soils at an inclination of 3:1 (horizontal to vertical) or flatter.

Fill Slopes: It is our opinion that fill slopes constructed at an inclination of 2:1 (horizontal to vertical) or flatter will be stable at the proposed maximum height of 10 feet.

Fill slopes shall be keyed into dense natural ground. The key shall extend through all incompetent soil and be established at least 2 feet into dense competent material. The key shall be a minimum of 2 feet deep at the toe of slope and fall with 5% grade toward the interior of the proposed fill areas. The bottom of the key shall have a width of at least 15 feet (Plate No. 19).

All keys must be inspected by the Soil Engineer, Engineering Geologist or their representative in the field.

Whenever feasible, the soil material placed within the outer 15 feet of any fill slope, as measured inward horizontally from the face of the slope, should consist of on-site or imported granular soil material with an expansion index of 50 or less. Fill slopes constructed with clayey or expansive soils may experience creep and/or surficial failure.

We recommend that slopes be compacted by backrolling with a loaded sheepsfoot roller at vertical intervals not to exceed 4 feet and should be track walked at the completion of each slope. The face of the slopes should be compacted to no less than 90 % relative compaction (ASTM D1557-00). This can best be accomplished by over building the slope at least 4 feet and trimming to design finish slope grade.

Subdrains: A subdrain system should be installed within buttress or stability fills, or where fill is proposed over canyons or drainage areas. At this time, buttress or stability fills are not anticipated for this project. There is a possibility that short drainage areas may be uncovered within the eastern portion of the site. However, this is difficult to definitively evaluate until the earthwork begins. The final determination for the location of the subdrains shall be made by the Soil Engineer or Engineering Geologist during the site grading.

The subdrain shall consist of a trench at least 36 inches deep and 18 inches wide. Mirafi 140N or Amoco 4547 non-woven geotextile fabric, or an approved equivalent, shall line the bottom and sides of the trench. Four inches of 3/4-inch rock bedding shall be placed on the geotextile at the bottom of the trench. A perforated pipe with a diameter of at least 4 inches shall be placed in the trench with the perforations down. A 6-inch diameter pipe may be necessary where larger volumes of water are anticipated. The pipe shall be SDR 35 (ASTM-D3034) or an approved equal.

The drainpipe shall have a minimum 1% gradient and shall be centered within the trench horizontally. A minimum of 3 cubic feet of 3/4-inch rock per linear foot of subdrain shall be placed over and around the pipe within the geotextile lined trench. The geotextile shall lap at least 12 inches over the top of the rock. The subdrain shall outlet away from any structures or slopes in an approved, legal manner.

Surface Drainage: Surface drainage shall be directed away from structures and paved areas. The ponding of water or saturation of soils should not be allowed adjacent to any of the foundations. We recommend that planters be provided with drains and low flow irrigation systems. Gutter, roof drains and other drainage devices shall discharge water away from the structure into surface drains and storm sewers.

Surface water must not be allowed to drain in an uncontrolled manner over the top of any slope or excavation.

The exterior grades should be sloped to drain away from the structures to minimize ponding of water adjacent to the foundations. Minimum site gradients of at least 2% in the landscaped areas and of 1% in the hardscaped areas are recommended in the areas surrounding buildings. These gradients should extend at least 10 feet from the edge of the structure.

To reduce the potential for erosion, the slopes shall be planted as soon as possible after grading. Slope erosion, including sloughing, rilling, and slumping of surface soils may be anticipated if the slopes are left unplanted for a long period of time, especially during rainy seasons. Swales or earth berms are recommended at the top of all permanent slopes to prevent surface water runoff from overtopping the slopes. Animal burrows should be controlled or eliminated since they can serve to collect normal sheet flow on slopes, resulting in rapid and destructive erosion. Erosion control and drainage devices must be installed in compliance with the requirements of the controlling agencies.

Earthwork: All earthwork performed on-site must be accomplished in accordance with the attached Specifications for Construction of Controlled Fills (Appendix 1). All special site preparation recommendations presented in the sections above will supersede those in the Standard Specifications for Construction of Controlled Fills. All embankments, structural fill, and utility trench backfill shall be compacted to no less than 95% of its maximum dry density. The maximum dry density of each soil type shall be determined in accordance with ASTM D1557-00.

The moisture content of the granular fill soils should be within 2% of optimum moisture content at the time of compaction. The moisture content of the clayey soil materials should be maintained between 2% and 4% over optimum moisture content.

Prior to commencement of the brushing operation, a pre-grading meeting shall be held at the site. The Developer, Surveyor, Grading Contractor, and Soil Engineer should attend. Our firm should be given at least 3 days notice of the meeting time and date.

Foundation Recommendations

Seismic Site Categorization: The following seismic site categorization parameters may be used for foundation design. These design parameters are based on the information provided in Chapter 16 of the 2001 California Building Code.

Soil Profile Type = S_D

Near Source Factor $N_a = 1.2$

Near Source Factor $N_v = 1.6$

Seismic Source Type = A

Footings: The on-site overburden soils (alluvium) are not considered suitable for foundation or floor slab support. To provide more uniform support we recommend that proposed structures be entirely supported on compacted fill. Conventional footings should be underlain by at least 2 feet of compacted soil with an expansion index of 20 or less. Footings shall be designed with the minimum dimensions and allowable dead plus live load soil bearing values given in the following table:

Footings Established on Compacted Fill

Building Height	Minimum Depth (inches)	Minimum Width (inches)	Allowable Soil Bearing Value (p.s.f.)
One Story	12	12	1,800
Two Story	18	15	2,200

The minimum depth given shall be below **lowest adjacent** finish subgrade. If foundations are proposed adjacent to the top of any slope, we recommend that the footings be deepened to provide a horizontal distance of 8 feet between the outer edge of the footing and the adjacent slope face.

The soil load bearing values presented above may be increased by one-third for short-term loads, including wind or seismic. The soil load bearing values of any imported soil should be determined after its selection but prior to its delivery on-site.

All continuous footings shall be reinforced in accordance with recommendations provided by a Structural Engineer. As a minimum, continuous footings may be reinforced with two No. 4 bar top and two No. 4 bar bottom.

Concrete Slabs-On-Grade: If the soils are prepared as recommended in this report, concrete slabs-on-grade shall be supported entirely on compacted fill. For conventional foundations, soil material placed within 4 feet of finish subgrade should have an expansion index of 20 or less. No cut/fill transitions should be allowed to occur beneath the structures.

The concrete slab-on-grade should have a thickness of no less than 4 inches. Minimum reinforcement should consist of No. 4 bars placed 18 inches on center in both directions. A low-slump concrete (4-inch maximum slump) should be used to minimize possible curling of the slabs. The concrete slabs should be allowed to cure properly before placing vinyl or other moisture-sensitive floor covering. Optimum curing may be accomplished using burlap covers kept continuously moist for at least seven days. The floor covering contractor should test the slab for moisture vapor transmission requirements.

These recommendations are minimum only and may be enhanced or increased as directed by the Structural Engineer. Construction joint and weakened plane joint details, spacing and placement shall be provided by the Structural Engineer.

Slab-On-Grade Bedding: To provide protection against vapor or water transmission through the building and floor slabs, we recommend that the slabs-on-grade be underlain by a 4-inch layer of Caltrans Class 2 permeable material or gravel. A suggested gradation for the gravel layer is as follows:

Sieve Size	Percent Passing
3/4"	90-100
No. 4	0-10
No. 100	0-3

If the slab-on-grade is underlain by at least 4 feet of granular compacted fill, the gravel layer may be replaced by 4 inches of clean sand. If sand bedding is used, care should be taken during concrete placement to prevent displacement of the sand. An impermeable membrane as described below should be placed at the midpoint of the sand layer.

Impermeable Membrane: In areas where vinyl or other moisture-sensitive floor coverings are planned or where moisture may be detrimental to the structure's contents, we recommend that the 4-inch-thick gravel layer be overlain by a 15-mil thick impermeable plastic membrane (Stego Wrap or approved equal) to provide additional protection against water vapor transmission through the slab. The vapor barrier should be installed in accordance with the manufacturer's instructions. We recommend that the edges, laps and penetrations for pipes or other devices be sealed.

Transition Areas: Any proposed structures should not be allowed to straddle a cut-fill transition line. Footings and floor slabs should be entirely supported on cut or entirely on fill. The tendency of cut and fill soils to compress differently can frequently result in differential settlement, cracking to portions of the structure and in severe cases structural damage.

To reduce the potential for damage due to differential settlement in transition areas, we recommend that, on pads where the maximum fill thickness is less than 15 feet, cut areas be over-excavated to a depth of at least 2 feet below the bottom of the deepest footing. This should be replaced with very low expansive soil material compacted to at least 95% of its maximum dry density (ASTM D1557-00). If the fill thickness exceeds 15 feet (including removal and recompaction of incompetent soil), the cut portion should be over-excavated 4 feet below the bottom of the deepest footing. The compacted fill should extend at least 5 feet beyond the building floor plan.

Lateral Resistance: Resistance to lateral loads may be provided by friction at the base of the footings and floor slabs and by the passive resistance of the supporting soils. Allowable values of frictional and passive resistance are presented for the fill soils in the table below. The frictional resistance and the passive resistance of the materials may be combined without reduction in determining the total lateral resistance.

Lateral Resistance Values

Soil Type	Coefficient of Friction	Allowable Passive Pressure (p.s.f./ft. of depth)
Compacted On-Site Fill	0.35	350

Footing Observations: Prior to the placement of reinforcing steel and concrete, all foundation excavations shall be inspected by the Soil Engineer, Engineering Geologist or their representative. Footing excavations shall be cleaned of any loosened soil and debris before placing steel or concrete. Footing excavations should be observed and probed for soft areas. Any soft or disturbed soils shall be over-excavated prior to placement of steel and concrete.

Over-excavation of soils should not be performed in locations that were undercut for transition areas. This would compromise the thickness of the soil supporting the footings. In undercut transition areas loose soils should be recompacted.

Pavement Recommendations

Preliminary Flexural Pavement Design: The required paving and base thicknesses will depend on the subgrade soils and on the Traffic Index applicable to the intended usage. The near-surface soils generally consisted of silty, fine grained sands. A sample of near-surface soil was returned to the laboratory to determine its estimated Resistance Value (R-value). The test results are presented on Plate No. 15 of this report.

Paving sections were estimated for the subgrade soils based on an assumed Traffic Index of 5.0 for the proposed interior street. The asphalt paving sections were established based on Caltrans design criteria.

Location	R-value	Traffic Index	Flexural Pavement Structural Section
Interior Streets	61	5.0	3 Inches Asphaltic Concrete (AC) over 4 Inches Aggregate Base (AB)

The preceding recommendations are preliminary only. They should be confirmed by sampling and performing R-value tests on the soil material at subgrade elevation on completion of the earthwork.

These recommendations are subject to the review and approval of the governing agencies.

Base Materials: The aggregate base course should meet the specifications for Class 2 Aggregate Base as defined in Section 26 of the State of California, Department of Transportation, Standard Specifications, most current edition. Alternatively, the base course could meet the specifications for untreated base as defined in Section 200-2 of the latest edition of the Standard Specifications for Public Works Construction. The base course should be compacted to at least 95%. Careful inspection is recommended to verify that the specified thicknesses, or greater, are achieved and that proper construction procedures are used.

Subgrade Preparation: The subgrade soils should be prepared as recommended in the previous sections describing site preparation and earthwork. Compaction of the subgrade to at least 95%, including trench backfills, will be important for paving support.

Areas that will receive aggregate base shall be properly moistened and recompacted to no less than 95 percent of their maximum dry density, to a depth of at least 12 inches below subgrade. The preparation of the paving subgrade should be done immediately prior to the placement of the base course. Adequate drainage of the paved surface must be provided to reduce infiltration of water into the subgrade soils. To mitigate pavement damage from base, excessive moisture in the aggregate or subgrade soils, planters or landscaped areas should not be constructed adjacent to or near the pavement, unless planters are provided with properly designed drains.

Field Explorations

Subsurface conditions were explored by our observation of two (2) small diameter borings and ten (10) backhoe trenches between May 5 and May 23, 2005. The exploratory trenches were 24-inches in width, approximately 15 feet long and extended to depths ranging from 9½ to 15½ feet. The borings were 6 inches in diameter and advanced to depths of 10 to 50 feet. Caving occurred in several of the excavation walls. Groundwater was not observed in any of the trenches or borings. The locations of the exploratory excavations are depicted on the Site Plan, Plate No. 1, located in the back pocket of this report.

The surface reconnaissance and subsurface exploration were conducted by our geology and soil engineering personnel. The soils are described in accordance with the Unified Soil Classification System as illustrated on the attached simplified chart (Plate No. 2). In addition, a verbal textural description, the wet color, the apparent moisture and the density or consistency are presented. The density of granular material is given as either very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as either very soft, soft, medium stiff, stiff, very stiff or hard.

The sampling and logging of our exploratory excavations were performed using standard geotechnical methods. The logs are presented on Plate No. 3 through Plate No. 14. Samples of typical and representative soils were obtained and returned to our laboratory for observation and testing.

Laboratory Testing

Laboratory tests were performed in accordance with the American Society for Testing and Materials (ASTM) test methods or suggested procedures. Test results are shown on Plate No. 15 through Plate No. 17.

Plan Review

Western Soil and Foundation Engineering, Inc. should review the final grading and building plans for this project.

Limitations

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that are encountered during site development should be brought to the attention of the geotechnical consultant so that they may make modifications, if necessary.

This office should be advised of any changes in the project scope so that it may be determined if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

It is recommended that Western Soil and Foundation Engineering, Inc. be retained to provide continuous geotechnical engineering services during the earthwork operations. This is to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction. Western Soil and Foundation Engineering, Inc. and/or our consultants, will not be held responsible for earthwork of any kind performed without our observation, inspection and testing.

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the State-of-the-Art and/or Government Codes may occur. Due to such changes, the findings of the report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of one year without a review by us verifying the suitability of the conclusions and recommendations.

We will be responsible for our data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

It is the responsibility of the Client or the Client's representative to ensure that the information and recommendations contained herein are brought to the attention of the engineer and architect for the project and incorporated into the project's plans and specifications. It is further the responsibility of the Client to take the necessary measures to ensure that the contractor and sub-contractors carry out such recommendations during construction.

Respectfully submitted,
WESTERN SOIL AND FOUNDATION ENGINEERING, INC.

Vincent W. Gaby, CEG 1755, Expires 7/31/05
Engineering Geologist

Dennis E. Zimmerman, C 26676, GE 928, Expires 3/31/06
Geotechnical Engineer

VWG:DEZ/kmg

ATTACHMENTS

SITE PLANS

Plate No. 1

and

Plate No. 1A

(In Back Pocket)

SUBSURFACE EXPLORATION
LEGEND

UNIFIED SOIL CLASSIFICATION CHART

Soil Description	Group Symbol	Typical Names
I. COARSE GRAINED: More than half of material is larger than No. 200 sieve size.		
Gravels: More than half of coarse fraction is larger than No. 4 sieve size but smaller than 3".		
CLEAN GRAVELS	GW	Well graded gravels, gravel sand mixtures, little or no fines.
	GP	Poorly graded gravels, gravel sand mixtures, little or no fines.
GRAVEL W/FINES	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
	GC	Clayey gravels, poorly graded gravel-sand, clay mixtures.
Sands: More than half of coarse fraction is smaller than No. 4 sieve size.		
CLEAN SANDS	SW	Well graded sand, gravelly sands, little or no fines.
	SP	Poorly graded sands, gravelly sands, little or no fines.
SANDS W/FINES	SM	Silty sands, poorly graded sand and silt mixtures.
	SC	Clayey sands, poorly graded sand and clay mixtures.
II. FINE GRAINED: More than half of material is smaller than No. 200 sieve size.		
Silts & Clays: Liquid limit less than 50	ML	Inorganic silts and very fine sands, rock flour, sandy silt or clayey-silt-sand mixtures with slight plasticity.
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
	OL	Organic silty and organic silty clays of low plasticity.
Silts & Clays: Liquid limit greater than 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
	CH	Inorganic clays of high plasticity, fat.
	OH	Organic clays of medium to high plasticity.
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils.

Plate No. 2

TRENCH NO. T-1

ELEVATION ± 874

SAMPLING METHOD CASE 580 BACKHOE

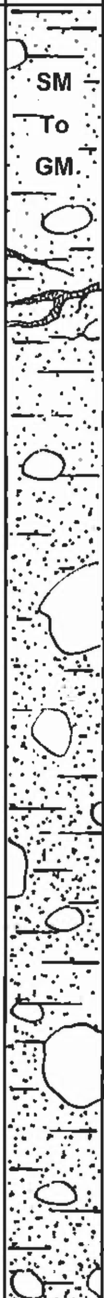
DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–2	C	SC	ALLUVIUM – Dark Brownish-Orange, Clayey, Fine to Medium Grained Sand	Moist	Medium Dense	120.1	12.6		0–2
			Grades To						
2–5		GM	Orangish-Brown, Silty, Fine to Medium Grained Sand with Abundant Cobble of Granitic Rock	Moist	Loose To Medium Dense				2–5
			(Isolated Boulder)						
			Grades To						
5–10		GW	Brownish-Gray, Pebbly to Cobbly, Fine to Very Coarse Grained Sand	Moist	Loose To Medium Dense				5–10
			Becomes Poorly Cemented						
10–14	C	GW	Grayish-Brown, Slightly Silty, Cobbly, Fine to Coarse Grained Sand	Moist	Medium Dense	115.5	6.7		10–14
14			BOTTOM OF TRENCH @ 14 FEET						14

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

Plate No. 3

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-2 ELEVATION ± 864 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–1		SM To GM	ALLUVIUM – Dark Brown, Slightly Cobbly, Silty, Fine Grained Sand	Very Moist	Loose				–1
2									–2
3			Minor Roots, Thin to Medium Thick						–3
4									–4
5			(Sidewalls Caving From 4 to 8 Feet)						–5
6	R					79.6	9.1		–6
7			Grades To Grayish-Brown, Slightly Silty, Fine to Coarse Grained Sand with Cobble and Boulders of Granitic Rock	Moist	Loose To Medium Dense				–7
8									–8
9			Grades To						–9
10			Dark Orangish-Brown, Silty, Fine to Medium Grained Sand with Cobble, Moderately Cemented	Moist To Very Moist	Medium Dense				–10
10½	C					125.0	11.2		
11									–11
12									–12
13									–13
14									–14
15			BOTTOM OF TRENCH @ 14½ FEET						–15
16									–16



JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-3 ELEVATION ± 878 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–2		GM	ALLUVIUM – Dark Brown, Silty, Fine to Medium Grained Sand with Abundant Cobble and Boulder of Granitic Rock	Moist	Loose To Medium Dense				0–2
			Grades To						
3–4		GM	Brown, Silty, Fine to Coarse Grained Sand with Abundant Cobble and Boulder	Moist To Damp	Loose To Medium Dense				3–4
			Grades To						
7–9½		GW To GM	Orangish-Brown, Slightly Silty, Fine to Coarse Grained Sand with Abundant Cobble, Moderately Cemented	Moist	Medium Dense				7–9½
9½			BOTTOM OF TRENCH @ 9½ FEET						9½
10–16									10–16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-4 ELEVATION ± 840 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
–		SC	ALLUVIUM – Orangish-Brown, Slightly Clayey, Silty, Fine to Medium Grained Sand	Moist	Loose To Medium Dense				–
1–									–1
–									–
2–			Grades To						–2
–	C	GW To GM	Slightly Silty, Cobbly, Fine to Coarse Grained Sand, Moderately Cemented	Moist To Damp	Medium Dense				–
3–									–3
–									–
4–									–4
–									–
5–			Grades To						–5
–									–
6–									–6
–	C	GW	Grayish-Brown, Slightly Silty, Pebbly to Cobbly, Fine to Coarse Grained Sand, Poorly to Moderately Cemented	Moist	Medium Dense	114.3	7.6		–
7–									–7
–									–
8–									–8
–									–
9–									–9
–									–
10–									–10
–									–
11–									–11
–									–
12–									–12
–									–
13–	C					122.0	6.0		–13
–									–
14–									–14
–									–
15–									–15
–									–
16–			BOTTOM OF TRENCH @ 15½ FEET						–16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-5 ELEVATION ± 838 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–1		SM	ALLUVIUM – Dark Brown, Silty, Fine Grained Sand	Moist	Loose				–1
1–2			Grades To						–2
2–4	B	SM To SC	Dark Orangish-Brown, Slightly Clayey, Silty, Fine to Medium Grained Sand, Poorly Cemented	Very Moist	Loose To Medium Dense				–3
4–5			Grades To						–4 –5
5–7	C	SM	Dark Grayish-Brown, Silty, Fine to Coarse Grained Sand Moderately Cemented with Minor Cobble	Moist	Medium Dense	121.2	8.9		–6 –7
7–8			Grades To						–8
9–13		GM To GW	Grayish-Brown, Slightly Silty, Pebbly to Cobbly, Fine to Coarse Grained Sand, Poorly Cemented	Moist	Medium Dense				–9 –10 –11 –12 –13
14–16			BOTTOM OF TRENCH @ 13½ FEET						–14 –15 –16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

Plate No. 7

TRENCH NO. T-6

ELEVATION ± 854

SAMPLING METHOD CASE 580 BACKHOE

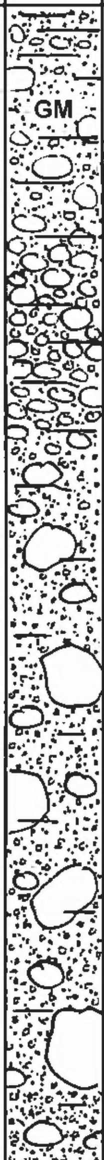
DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–5½		GW To GM	ALLUVIUM – Grayish-Brown, Slightly Silty, Fine to Coarse Grained Sand with Abundant Cobble and Boulders of Granitic Rock	Moist To Damp	Loose				0–5½
5½–9		SM To GM	ALLUVIUM – Dark Brown, Silty, Fine Grained Sand with Pebble and Cobble Grades To	Moist	Loose To Medium Dense				5½–9
9–11½		GM	Very Pebbly to Cobbly Sand	Moist	Loose				9–11½
11½–16			BOTTOM OF TRENCH @ 11½ FEET NOTE: Trench could not be advanced deeper due to unavailable space for spoils						11½–16

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 (left); –1, –2, –3, –4, –5, –6, –7, –8, –9, –10, –11, –12, –13, –14, –15, –16 (right)

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-7 ELEVATION ± 833 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–13		GM	ALLUVIUM – Grayish-Brown, Silty, Very Pebbly to Cobbly, Fine to Medium Grained Sand with Minor Boulders	Damp	Loose To Medium Dense				0–13
			Clast Supported Zone Sidewalls Caving from 2 Feet to 6 Feet						
			Grades To						
			Dark Brownish-Gray, Slightly Silty, Fine to Coarse Grained Sand with Abundant Cobble and Boulder of Granitic Rock	Damp To Moist	Loose To Medium Dense				
13			BOTTOM OF TRENCH @ 13 FEET						13
14–16									14–16



JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

Plate No. 9

TRENCH NO. T-8

ELEVATION ± 824

SAMPLING METHOD CASE 580 BACKHOE

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–1		SC	ALLUVIUM – Dark Brown, Silty, Fine Grained Sand	Damp	Loose				0–1
1–2			Grades To						1–2
2–4		GM	Clast Supported, Pebble to Cobble Conglomerate (Minor Boulders) In Matrix of Grayish-Brown, Silty Sand	Damp	Loose To Medium Dense				2–4
4			Grades To						4
5–12		GM	Cobble to Boulder Conglomerate Supported in Matrix of Grayish-Brown, Silty, Fine to Coarse Grained Sand	Damp To Moist	Loose To Medium Dense				5–12
7			(Moderate Sidewall Caving, Full Depth)						7
12			BOTTOM OF TRENCH @ 12 FEET						12
13–16									13–16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	TRENCH NO. T-9 ELEVATION ± 805 SAMPLING METHOD CASE 580 BACKHOE DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–2		SM To GM	ALLUVIUM – Dark Brownish-Gray, Silty, Fine to Coarse Grained Sand with Minor Pebble to Cobble	Damp To Moist	Loose				0–2
2–3			Grades To						2–3
3–6		GW To GM	Grayish-Brown, Slightly Silty, Pebbly to Cobbly, Fine to Coarse Grained Sand	Moist	Loose To Medium Dense				3–6
6	C					114.7	5.0		6
6–8		SM To GM	Fewer Pebbles and Cobble from Approximately 6 Feet to 8 Feet						6–8
8–14		GW	Cobble to Boulder Conglomerate Supported in Matrix of Grayish-Brown, Slightly Silty, Fine to Coarse Grained Sand	Moist	Medium Dense				8–14
14–16			BOTTOM OF TRENCH @ 14 FEET						14–16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

TRENCH NO. T-10

ELEVATION ± 811

SAMPLING METHOD CASE 580 BACKHOE

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	RELATIVE COMPACTION %	DEPTH (FEET)
0–2		SM To GM	ALLUVIUM – Grayish-Brown, Silty, Pebbly, Fine to Medium Grained Sand	Damp	Loose				0–2
			Grades To						
2–3.5		GM	Clast Supported, Cobble Conglomerate In Grayish-Brown, Silty Sand Matrix	Damp	Loose				2–3.5
			Grades To						
4–7	B (4–8)	GW	Cobble to Boulder Conglomerate Supported in Matrix of Grayish-Brown, Slightly Silty, Fine to Coarse Grained Sand	Damp	Loose To Medium Dense				4–7
			Matrix Material						
			Grades To						
7.5–12.7		GW	Gray, Fine to Very Coarse Grained Sand	Damp	Medium Dense				7.5–12.7
12.7–14		GM	ALLUVIUM – Dark Grayish-Brown, Slightly Silty, Pebbly, Fine to Coarse Grained Sand	Moist	Loose To Medium Dense				12.7–14
14			BOTTOM OF TRENCH @ 14 FEET						14

Depth scale: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-05-05	VWG

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	BORING NO. B–1 ELEVATION ± 845 SAMPLING METHOD 6-INCH HOLLOW CORE AUGER DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	BLOW COUNT PER INCH	DEPTH (FEET)
			ALLUVIUM – Pale Grayish-Brown, Silty, Fine to Coarse Grained Sand and Gravel-Sized Pebble and Cobble	Dry	Loose				
			REFUSAL @ 12 FEET ON ROCK						

JOB NUMBER 05-22	CLUB ESTATES SUBDIVISION	DATE LOGGED 05-23-05	LOGGED BY NSB

SUBSURFACE EXPLORATORY LOG

Plate No. 13

BORING NO. B–2

ELEVATION ± 805

SAMPLING METHOD 6-INCH HOLLOW CORE AUGER

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	BLOW COUNT PER INCH	DEPTH (FEET)
		SM	ALLUVIUM – Pale Brownish-Gray, Silty, Fine to Coarse Grained Sand and Pebble with Randomly-Sized Rock	Dry	Loose				
5				Damp	Loose				5
			Grades To						
10									10
15	R	SM	Pale Brownish-Gray, Silty, Fine to Medium Grained Sand and Gravel-Sized Granitic Pebble	Moist	Medium Dense	118.1		CAL 21/12	15
			Grades To						
20	R	SW	Pale Brownish-Gray, Fine to Coarse Grained Sand and Gravel-Sized Pebble	Moist	Dense			CAL 48/12	20
		SW	Pale Brownish-Gray, Fine to Medium Grained Sand	Moist	Dense				
25	B							SPT 35/12	25

(CONTINUES ON NEXT PAGE)

JOB NUMBER		DATE LOGGED	LOGGED BY
05-22	CLUB ESTATES SUBDIVISION	05-23-05	NSB

SUBSURFACE EXPLORATORY LOG

DEPTH (FEET)	SAMPLE TYPE	SOIL CLASSIFICATION	BORING NO. B–2 ELEVATION ± 805 SAMPLING METHOD 6-INCH HOLLOW CORE AUGER DESCRIPTION	APPARENT MOISTURE	APPARENT CONSISTENCY	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	BLOW COUNT PER INCH	DEPTH (FEET)
			(CONTINUED FROM PREVIOUS PAGE)						
26									26
30	B	SM	Olive-Gray, Silty, Fine to Medium Grained Sand	Moist	Medium Dense			SPT 14/12	30
35	B	SM	Dark Olive-Gray, Silty, Very Fine Grained Sand	Moist	Medium Dense			SPT 17/12	35
40		SP	Pale Brownish-Gray, Silty, Fine Grained Sand	Damp	Medium Dense			SPT 29/12	40
45		SW	Pale Gray, Fine to Coarse Grained Sand	Damp	Dense			SPT 41/12	45
50		SM	Pale Gray, Silty, Fine to Coarse Grained Sand	Damp	Dense			SPT 32/12	50
			BOTTOM OF BORING @ 50 FEET						

JOB NUMBER 05-22	CLUB ESTATES SUBDIVISION	DATE LOGGED 05-23-05	LOGGED BY NSB

SUBSURFACE EXPLORATORY LOG

Plate No. 14

LABORATORY TEST RESULTS – Cont.

Mechanical Sieve Analysis

Sample Location	Percent Passing U.S. Standard Sieve				
	#4	#10	#40	#100	#200
T-9 @ 6'	90.0	82.0	51.7	26.1	15.2
B-2 @ 25'	98.2	94.5	57.9	23.2	11.0
B-2 @ 30'	98.2	93.9	70.2	42.5	30.7
B-2 @ 35'	95.1	90.6	67.6	43.8	31.0
B-2 @ 45'	94.5	81.0	31.5	12.9	7.1

In-Situ Moisture and Density

Sample Location	Dry Density (pcf)	Moisture Content (%)
T-1 @ 2'	120.1	12.6
T-1 @ 11'	115.5	6.7
T-2 @ 6'	79.6	9.1
T-2 @ 10½'	125.0	11.2
T-4 @ 6½'	114.3	7.6
T-4 @ 13'	122.0	6.0
T-5 @ 5'	121.2	8.9
T-9 @ 6'	114.7	5.0
B-2 @ 15'	118.1	3.6

LABORATORY TEST RESULTS

Maximum Density/Optimum Moisture

Sample Location	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
T-1 @ 1' to 4'	Orangish-Brown, Silty, Fine to Coarse Grained Sand	131.1	10.4
T-5 @ 2' to 4'	Dark Orangish-Brown, Slightly Clayey, Silty, Fine to Medium Grained Sand	130.4	10.7
T-10 @ 4' to 8'	Grayish-Brown, Gravelly, Silty, Fine to Coarse Grained Sand	136.2	6.5

Direct Shear

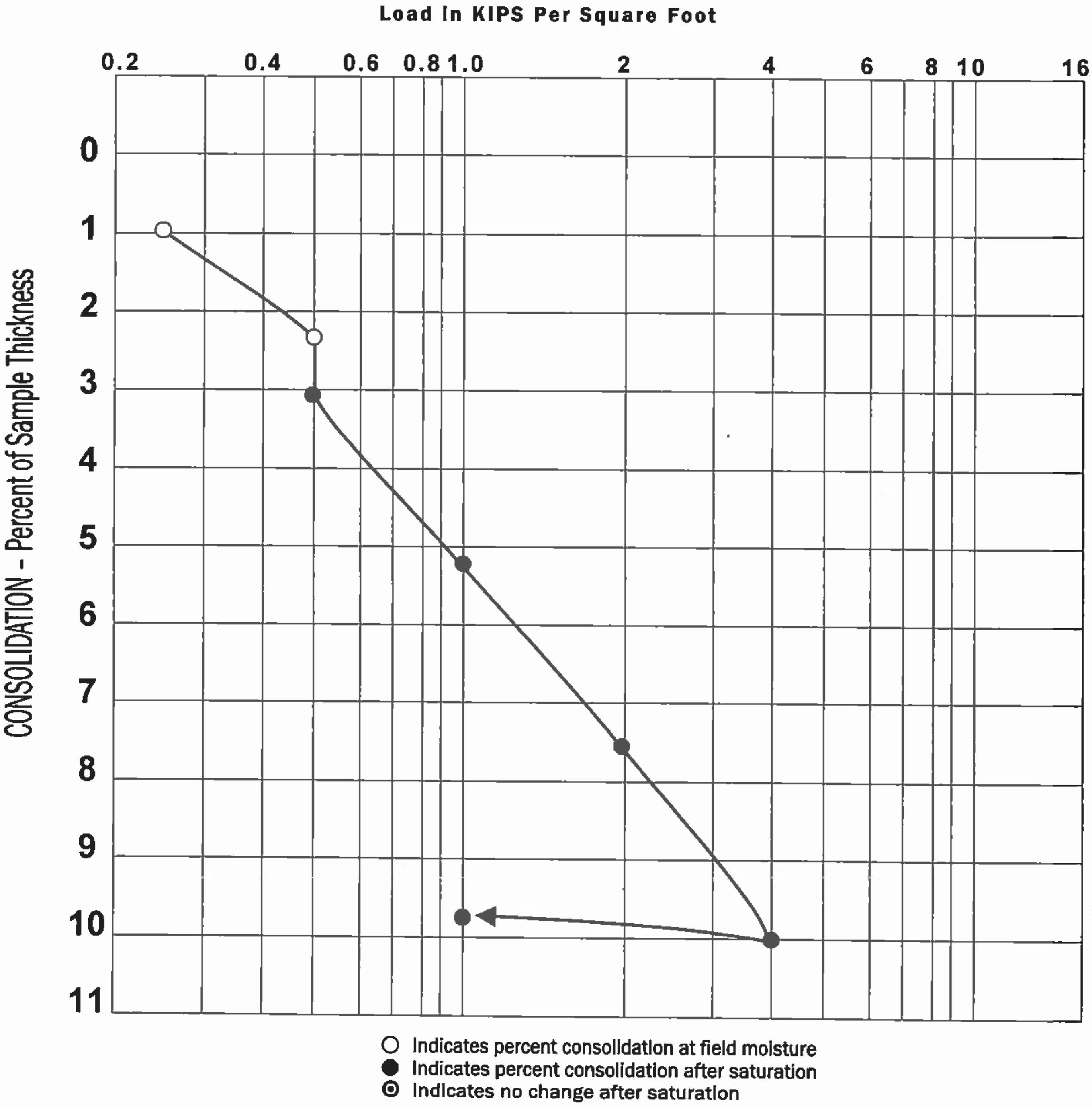
Sample Location	Apparent Cohesion (psf)	Angle of Internal Friction (degrees)
*T-1 @ 1' to 4'	200	33

*Sample remolded to 90 percent of maximum dry density and 3 percent over optimum moisture content. All samples were saturated prior to testing.

Resistance Value

Sample	R-Value
T-1 @ 1' to 4'	61

CONSOLIDATION CURVES



DATE: 07-11-05	**CLUB ESTATES SUBDIVISION** **T-2 @ 6 FEET**	JOB NO. 05-22
BY: VWG		Plate No. 17

WESTERN
SOIL AND FOUNDATION ENGINEERING, INC.

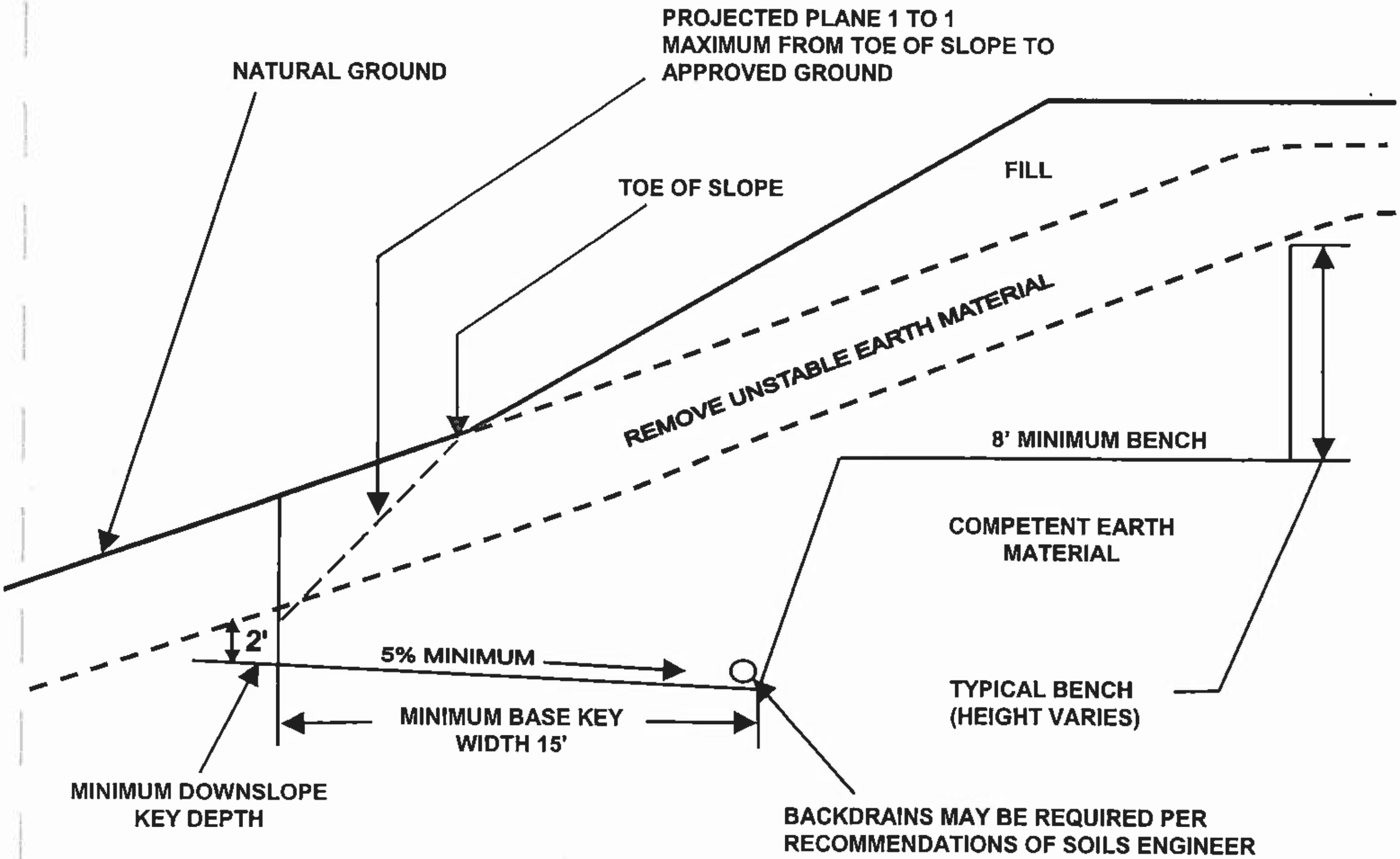
TABLE 1

Trench or Boring Number	Depth of Soil Removal Below Existing Grade (ft.)
T-1	8
T-2	9
T-3	7
T-4	7
T-5	6
T-6	10+
T-7	10+
T-8	8
T-9	7
T-10	8
B-1	10+
B-2	10

NOTE: It should be recognized that variations in soil conditions may occur between exploratory excavations that will require additional removal. Additional excavation may be necessary for transition line over-excavation and/or removal of expansive soils. In areas where fill slope toe keys are proposed, add a minimum of 2 feet to removal depths presented above.

Exploratory trenches encountered in the removal process should be recompacted an additional 2 feet be Exploratory trenches encountered in the removal process should be recompacted an additional 2 feet below the depths shown in the above table.

FILL SLOPE KEY



CLUB ESTATES SUBDIVISION	
JOB NO.: 05-22	DATE: 07-11-05

Plate No. 19

WESTERN
SOIL AND FOUNDATION ENGINEERING, INC.

APPENDIX I

SPECIFICATIONS FOR CONSTRUCTION OF CONTROLLED FILLS

General Description: The construction of controlled fills shall consist of adequate geotechnical investigations, and clearing, removal of existing structures and foundations, preparation of land to be filled, excavation of earth and rock from cut area, compaction and control of the fill, and all other work necessary to complete the grading of the filled area to conform with the lines, grades, and slopes as shown on the accepted plans.

Clearing And Preparation Of Areas To Be Filled:

(1) All fill control projects shall have an investigation or a visual examination, depending upon the nature of the job, performed by a qualified soil engineer prior to grading.

(2) All timber, trees, brush, vegetation, and other rubbish shall be removed, piled and burned, or otherwise disposed of to leave the prepared area with a finished appearance free from unsightly debris.

(3) Any soft, swampy or otherwise unsuitable areas, shall be corrected by drainage or removal of compressible material, or both, to the depths indicated on the plans or as directed by the soil engineer.

(4) The natural ground which is determined to be satisfactory for the support of the filled ground shall then be plowed or scarified to a depth of at least six inches (6") or deeper as specified by the soil engineer, and until the surface is free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

(5) No fill shall be placed until the prepared native ground has been approved by the soil engineer.

(6) Where fills are made on the hillsides with slopes greater than 5 (horizontal) to 1 (vertical), horizontal benches shall be cut into firm undisturbed natural ground to provide lateral and vertical stability. The initial bench at the toe of the fill shall be a least 10 feet in width on firm undisturbed natural ground at the elevation of the toe stake. The soil engineer shall determine the width and frequency of all succeeding benches which will vary with the soil conditions and the steepness of slope.

(7) (After the natural ground has been prepared, it shall be brought to the proper moisture content and compacted to not less than 90% of maximum density, A.S.T.M. D1557-00.

(8) Expansive soils may require special compaction specifications as directed in the report of geotechnical investigation by the soil engineer.

(9) The cut portions of building pads may require excavation and recompaction for density compatibility with the fill as directed by the soil engineer.

Materials: The fill soils shall consist of select materials graded so that at least 40 percent of the material passes the No. 4 sieve. The material may be obtained from the excavation, a borrow pit, or by mixing soils from one or more sources. The material used shall be free from vegetable matter, and other deleterious substances, and shall not contain rocks or lumps greater than 6 inches in diameter. If excessive vegetation, rocks, or soils with unacceptable physical characteristics are encountered, these materials shall be disposed of in waste areas designated on the plans or as directed by the soil engineer. If soils are encountered during the grading operation which were not reported in the report of geotechnical investigation, further testing will be required to ascertain their engineering properties. Any special treatment recommended in the preliminary or subsequent soil reports not covered herein shall become an addendum to these specifications.

No material of perishable, spongy, or otherwise unstable nature shall be used in the fills.

Placing, Spreading And Compacting Fill Material:

(1) The selected fill material shall be placed in layers which shall not exceed six inches (6") when compacted. Each layer shall be spread evenly and shall be thoroughly blade-mixed during the spreading to insure uniformity of material and moisture in each layer.

(2) When the moisture content of the fill material is below that specified by the soil engineer, water shall be added until the moisture content is near optimum as determined by the soil engineer to assure thorough bonding during the compacting process.

(3) When the moisture content of the fill material is above that specified by the soil engineer, the fill material shall be aerated by blading and scarifying, or other satisfactory methods until the moisture content is near optimum as determined by the soils engineer.

(4) After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to not less than the specified maximum density in accordance with A.S.T.M. D1557-00. Compaction shall be by means of tamping or sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other types of rollers. Rollers shall be of such design that they will be able to compact the fill to the specified density. Rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density. The entire area to be filled shall be compacted to the specified density.

(5) Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compacting operations shall be continued until the slopes are stable and until there is no appreciable amount of loose soil on the slopes. Compacting of the slopes shall be accomplished by backrolling the slopes in increments of 3 to 5 feet in elevation gain or by other methods producing satisfactory results.

(6) Field density tests shall be made by the soil engineer for approximately each foot in elevation gain after compaction, but not to exceed two feet in vertical height between tests. The location of the tests in plan shall be spaced to give the best possible coverage and shall be taken no farther than 100 feet apart. Tests shall be taken on corner and terrace lots for each two feet in elevation again. The soil engineer may take additional tests as considered necessary to check on the uniformity of compaction. Where sheepsfoot rollers are used, the tests shall be taken in the compacted material below the disturbed surface. No additional layers of fill shall be spread until the field density tests indicate that the specified density has been obtained.

(7) The fill operation shall be continued in six inch (6") compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

Supervision: Supervision by the soil engineer shall be made during the filling and compacting operations so that he/she can certify that the fill was made in accordance with accepted specifications.

The specifications and soil testing of subgrade, subbase, and base materials for roads, or other public property shall be done in accordance with specifications of the governing agency.

Seasonal Limits: No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, grading shall not be resumed until field tests by the soil engineer indicate that the moisture content and density of the fill are as previously specified. In the event that, in the opinion of the engineer, soils unsatisfactory as foundation material are encountered, they shall not be incorporated in the grading, and disposition will be made at the engineer's discretion.

APPENDIX II

REFERENCES

Greensfelder, R.W., 1974, *Maximum Credible Rock Acceleration from Earthquakes in California,* Division of Mines and Geology, Map Sheet 23.

Kennedy, M.P., 1977, *Recency and Character of Faulting Along the Elsinore Fault Zone in Southern Riverside County, California,* California Division of Mines and Geology, Special Report 131.

McEuen, R.D., and Pinckney C.J., 1973, *Seismic Risk in San Diego, in Studies on the Geology and Geologic Hazards of the Greater San Diego Area, California,* San Diego Association of Geologists.

Rockwell, T.K. 1989, *Holocene Activity of the Rose Canyon Fault in San Diego Based on Trenching Studies: Evidence of M6+ Surface Rupturing Earthquakes, in: The Seismic Risk in the San Diego Region: Special Focus on the Rose Canyon Fault System.*

Schnabel, P.B. and Seed, H.B., 1972, *Accelerations in Rock for Earthquakes in the Western United States*, EERC Report 72-2, University of California, Berkley.

Seed, H.B. and Idriss, I.M., 1982, *Ground Motions and Soil Liquefaction During Earthquakes*, EERI Monograph Series.

Vaughn, P. and Rockwell, T., 1986, *Alluvial Stratigraphy and Neotectonics of the Elsinore Fault Zone at Agua Tibia Mountain, Southern California.*